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ERRATA.

Page 52, line 40, for "weakly acid to distinctly alkaline" read "weakly to distinctly alkaline"

,, 119, line 4, for "*tarsalus*" read "*tarsalis*"

,, 153, line 33, for "AITKEN (T. H. C.)" read "AITKEN (T. H. G.)"

IMPERIAL INSTITUTE OF ENTOMOLOGY.

REVIEW
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TEESDALE (C.). **Fertilization in the Tsetse Fly,** *Glossina palpalis*, **in a Population of low Density.**—*J. Anim. Ecol.* **9** no. 1 pp. 24–26, 7 refs. London, 1940.

Glossina palpalis, R.-D., has been practically eliminated from much of the bush on the Kuja river and its tributaries in the South Kavirondo district of the Nyanza Province, Kenya, by the block method of control [*R.A.E.*, B **25** 165 ; **27** 88]. Its density, as measured by fly rounds, has been reduced from about 100–200 flies per boy-day to about 1, but its complete eradication is difficult, if not impossible. It is sometimes thought that if a population is greatly reduced it will die out, because the sexes will not meet sufficiently often for an adequate number of females to be fertilised. In an investigation on this point carried out in 1938 in 6 blocks on the Kuja river or its tributaries, where the average male and female densities were 0·61 and 0·51 per boy-day, 1,737 females were examined. The spermathecae were dissected out, and in fertilised females the spermatozoa could be clearly seen. Only 6·16 per cent. of the females were found to be unfertilised, and most of these were recently emerged. There is, therefore, no indication that the males and females had difficulty in meeting or that the remaining population is likely to die out.

Joint Blowfly Committee. The Prevention and Treatment of Blowfly Strike in Sheep. Report No. 2.—*Pamphl. Coun. sci. industr. Res. Aust.* no. 98, 45 pp., 19 figs., 27 refs. Melbourne, 1940.

This second report of the Sheep Blowfly Committee [*cf. R.A.E.*, B **21** 118] is a review of the whole question of the prevention and control of infestation of sheep by blowflies in Australia. The introduction deals chiefly with the circumstances that predispose sheep to strike. The methods of preventing it are then dealt with under three main headings, *viz.*, those designed to reduce the inherent predisposition of sheep to infestation, their immediate susceptibility, and the abundance of the flies. The subjects discussed under the first heading are selective breeding, Mules' operation and the significance

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of the length of the docked tail [*cf.* **27** 197]; under the second, crutching and ringing, jetting, breech dipping, the protection of rams' heads by jetting, swabbing or dry dressings, the prevention of sepsis, and lamb marking; and under the third, traps and poison baits, the disposal of carcasses and the destruction of maggots in crutchings. The final section deals with the treatment of strike by removing the maggots and applying an antiseptic dressing.

ROBERTS (F. H. S.). **The Insect Parasites of Sheep.**—*Qd agric. J.* **53** pt. 6 pp. 530–546, 13 figs. Brisbane, 1940.

The main part of this paper consists of a review of data on blowflies infesting sheep in Queensland, including the appearance of the more important species, their bionomics, the different types of strike, the factors that render sheep liable to infestation and methods of control. Briefer notes are given on the bionomics and control of the sheep ked (*Melophagus ovinus*, L.), the sheep nasal-fly (*Oestrus ovis*, L.), and lice (*Bovicola ovis*, L., and *Linognathus pedalis*, Osb.). Simuliids are the only other insects of importance as pests of sheep in Queensland; they cause serious irritation, and lambs are sometimes killed by them, but no method of control has been found practicable except the use of smudge fires.

The Control of External Parasites of Poultry. The Control of Mites and Lice on the Poultry Plant.—*Publ. Dep. Agric. Canada* no. 675 4 pp. Ottawa, 1939. [Recd. 1940.]

Recommendations are made for the control of body lice and three species of mites [*Dermanyssus gallinae*, DeG., *Liponyssus sylviarum*, C. & F., and *Cnemidocoptes mutans*, Robin & Lanq.] that infest fowls in Ontario. The best treatment against the lice is fumigation with nicotine sulphate (40 per cent. solution) applied in a thin line along the top of the perches in the fowl house just before the fowls go to roost [*R.A.E.*, B **19** 139, 182]. Against *D. gallinae*, which does not remain on the birds during the day, the interior of the fowl house should be thoroughly cleaned and sprayed with strong coal-tar disinfectant. A paint composed of 1 part crude carbolic acid or nicotine sulphate and 3 or 4 parts kerosene or a mixture of kerosene and crank-case oil is recommended for use on perches and nest-boxes. *L. sylviarum* remains on the fowls by day and night and must be controlled on them as well as in the fowl houses. An ointment made of 2 parts vaseline and 1 part naphthalene flakes, rubbed into the skin round the tail and vent, has proved satisfactory, but nicotine sulphate has not been so successful against this mite as against lice [*cf.* **19** 139, 185; **26** 2; **27** 39]. For the house, thorough spraying of all parts including the litter with any strong disinfectant is reasonably successful. *Cnemidocoptes mutans* infests the legs of the birds, which should be treated with lard containing 6 per cent. carbolic acid or dipped in crude petroleum or kerosene. To make a disinfectant for use against the other two mites, 1½ lb. concentrated lye is dissolved in as small a quantity as possible of water, left until cold and stirred into 3 quarts of raw linseed oil; 2 gals. crude carbolic acid is then added, and the mixture is stirred until clear dark brown. It is used as a spray at the rate of 2–3 fl. oz. in 2 gals. water.

HU (S. M. K.). **The House-frequenting Behavior of *Anopheles hyrcanus* var. *sinensis* Wiedemann in the Shanghai Area, Part 3.—Indoor Resting Places.**—*Lingnan Sci. J.* **19** no. 3 pp. 403–410, 2 pl., 1 plan, 4 refs. Canton, 1940.

In connection with experiments on the behaviour of *Anopheles hyrcanus* var. *sinensis*, Wied., in the Shanghai area [*R.A.E.*, B **28** 41, etc.], observations were carried out in a rural area on its daytime resting places in farm houses. During fortnightly collections made in four rooms of one house between 20th April and 9th November 1934, 1 male and 261 females of this Anopheline were taken, 213 being in the bedroom. The window of this room was usually left open at night in the hot season, whereas the windows of the other rooms were closed at 8–9 p.m. Of the 13 found in the living room, 10 were collected on 4th July during a brief period when the room was being occupied at night. Only 19 of the 30 females found in the storeroom were engorged, though fowls were kept there during the evening. The smallest number of Anophelines (5) was taken in the kitchen, probably on account of the presence of smoke. In 4 other farm houses examined on 4th July, many more mosquitos were found in bedrooms than in the other rooms. Screening the bedroom windows is recommended, as the doors of these rooms are usually kept closed night and day. Of 861 females collected in bedrooms in 1934 and 1935, 55 per cent. were taken inside the bed nets, which were hardly ever properly closed. A high proportion of all the females taken had engorged, and there appeared to be no correlation between the number of males in the houses and the proximity of suitable breeding places, for, though the latter were numerous, very few males were taken [*cf.* **13** 55].

STRAHAN (J. H.). **A Review of the Results of Malaria Control on Rubber Estates in Negri Sembilan South from 1931–1939.**—*J. Malaya Br. Brit. med. Ass.* **4** no. 1 pp. 53–65, 11 graphs, 1 plan. Singapore, 1940.

Statistics are given on the incidence of malaria during the years 1931–39 on eight rubber estates in Negri Sembilan South, Federated Malay States. In each case a brief description is given of the type of the estate, its vital statistics for the nine years, malarial conditions prevailing and methods of control practised. It is suggested that the data show that, in this area, which for past years has depended on a rigid acceptance of the half-mile oiling zone for protection from malaria, reasonable control has not been established, and that *Anopheles maculatus*, Theo., breeds so intensively that it reaches the lines from outside the half-mile area in numbers sufficient to cause a higher incidence of malaria and more deaths than elsewhere in the Federated Malay States, with the exception of Pahang. The findings of Wallace [*R.A.E.*, B **28** 6] and Holmes [**27** 210] on the failure of half-mile control in certain areas and the range of flight of *A. maculatus* are thus confirmed. As a basis of control in the future, it is suggested that where the measures adopted in the past have failed seriously and are still ineffective, chemo-prophylaxis should be employed, that mosquitos should be trapped in the lines, and that if *A. maculatus* is found, the control area should be increased outside the half-mile by suitable means (cover, fascine drainage where possible and flushes), and that chemo-prophylaxis should be continued as long as *A. maculatus* is caught in the traps.

AFRIDI (M. K.) & PURI (I. M.). **Studies on the Behaviour of Adult *Anopheles culicifacies*. Part I. Review of Literature.**—*J. Malar. Inst. India* **3** no. 1 pp. 1–22, 1 pl., 4 pp. refs. Calcutta, 1940.

AFRIDI (M. K.), MAJID (A.) & SHAH (I. A.). **Part II.**—*T.c.*, pp. 23–51, 1 map, 5 charts, 16 refs.

The finding that *Anopheles culicifacies*, Giles, apparently plays no part in the transmission of malaria in the Jeypore Hills Tract [*cf.* *R.A.E.*, B **25** 191 ; **26** 231] is considered to throw doubt on the racial unity of this species, which is a vector of importance in other parts of India. Further investigations on it have, therefore, been undertaken, and in the first part of this paper the literature on its seasonal prevalence, resting places, feeding habits, longevity, hibernation and aestivation, and on its powers of flight and dispersion in different parts of India is reviewed.

It is concluded that in the north-western region of India, the seasonal prevalence of *A. culicifacies* is restricted to the hot humid months of July–September and in the north-eastern region to the pre-monsoon months (April–June), whereas in southern India, an increase occurs in the winter and spring. It is pre-eminently a domestic species. In northern India, it tends to hide in cracks and crevices and is, therefore, difficult to catch, whereas in the Jeypore Hills Tract it can readily be taken in large numbers. There are conflicting reports regarding both the type of resting place selected and the character of its nocturnal movements ; its behaviour in these respects differs in Bengal from that observed in other parts of India. Even in localities where it is an effective vector of malaria, it does not appear to feed habitually on man, the proportion of cattle to man in a locality being one of the most important factors determining the percentage that does so. It feeds chiefly about midnight, but has been reported to do so in the daytime also. The biting stimulus is said to be more pronounced in some months than in others. There is no evidence of true hibernation of the adults. In north-western India, where climatic conditions are severe at that time of year, the winter is passed as hibernating larvae. In order to maintain an average length of life of 7–21 days under laboratory conditions, a higher range of humidity is required when the temperature rises above 67°F. than when it is below that level. In the field, the length of life, as deduced from a fall in the sporozoite rate, has been found to decrease during the period January–April. The flight range is not normally more than half-a-mile from breeding places, but towards the end of the malaria season it may be greater, especially over open treeless tracts. The adults disperse in all directions in their search for breeding places and food, and constantly change their feeding and resting places.

In the second part of the paper, an account is given of investigations carried out at a small village near Karnal (Punjab) from June 1936 to December 1938 to obtain information on the numerical prevalence, longevity, dispersion and sexual activities of *A. culicifacies* under various climatic conditions. Data on the numerical prevalence were obtained from catching stations and traps, and on longevity, powers of dispersion and ovarian development by release and recapture of marked mosquitos, each batch being dusted with a powder of distinctive colour [*cf.* **25** 193]. Longevity was also determined under laboratory conditions.

The following is taken from the authors' summary and conclusions : The numerical increase of *A. culicifacies* began with the onset of the monsoon at the end of July. At this time the mosquitos were active and dispersed freely up to a distance of 500 yards. Ovarian development took place fairly rapidly, the full cycle taking less than 3–4 days. The rate of mortality was high, and the average length of life approximately 5–6 days. By the middle of September, the numbers had decreased and there were signs of the slowing down of biological activities, especially with regard to the ovarian cycle, which was somewhat prolonged. The average length of life was also longer, approximately 7–8 days, but there was no tendency towards a restriction in the range of dispersal. From the middle of November to the end of December, vital activities were retarded still further, the ovarian cycle taking 4–8 days. The average longevity in the laboratory was 12–15 days, older mosquitos formed a higher proportion of the population, and movement became more and more restricted as winter conditions supervened. In January and February, when the minimum temperature fluctuated between 40 and 50°F., the numbers fell sharply. Mosquitos caught at this time were old, and their movements were confined to short flights between adjoining houses. They were often engorged with fresh blood, and ovarian development, though greatly retarded, did not cease entirely. Pupae could still be collected, but the number of adults emerging was small. There was a sharp increase in numbers after March, but the density in May and June was not nearly so high as in the monsoon and autumn months. The length of life of the examples comprising the early spring broods, with the exception of those prevalent in April 1937, averaged 4 days in nature, and became especially reduced as the minimum temperature rose above 60°F. ; however, a few examples were recaptured 14–21 days after release. Dispersion does not appear to have been restricted, since dusted mosquitos were taken 500 yards from the release station. During 1938, the failure of the rains resulted in a great reduction in density and the autumn rise did not occur. Some of the batches released in December and May included examples that lived for unusually long periods, and these may possibly represent broods particularly fitted to withstand unfavourable climatic conditions.

JOHN (C. C.). **Observations on the Utility of *Aplocheilus lineatus* (Cuv. & Val.) for Mosquito Control.**—*J. Malar. Inst. India* **3** no. 1 pp. 67–80, 11 refs. Calcutta, 1940.

The range of *Aplocheilus* (*Panchax*) *panchax*, a fish that has proved of value in the control of Anopheline larvae [*cf. R.A.E.*, B **27** 8], includes Bengal and Orissa, but does not extend to the peninsular part of India, where it is replaced by *A. lineatus*. These investigations were carried out to determine the feeding habits of the latter and whether it could be used to control mosquitos breeding in wells. Notes are given on its appearance, behaviour and habitat.

The following is taken from the author's summary : *A. lineatus* feeds exclusively on small Crustacea, insects and insect larvae, including those of Chironomids and mosquitos. In the laboratory, it devoured an average of about 80 mosquito larvae in 9 hours. Field observations showed that, even when the water is rich in different types of small aquatic organisms, it exhibits a definite preference for mosquito larvae, and only when these are scarce or absent does it feed on other animal

matter. In wells, it remained healthy and active and within 2 weeks completely controlled mosquito breeding. Repeated counts at intervals of 2 weeks showed the presence of small mosquito larvae in certain cases only. These had probably escaped destruction owing to their size, but since no large larvae or pupae were present, the finding does not prove the ineffectiveness of the fish. In wells from which the fish had been accidentally removed, the mosquito larvae rapidly reached their original density, whereas those in which fish were continuously present remained free.

A. lineatus adapts itself to varied conditions and thrives in deep wells, stagnant ponds or muddy pools and even in small artificial containers. Neither the depth of the wells nor the depth of the water in them seems to affect its health. When mosquito larvae become scarce, it subsists on other small insects, but in no circumstances shows any tendency to cannibalism. The fact that it remains near the surface subjects it to the risk of being hauled up with the water, but if care is taken to re-stock the wells periodically, breeding of mosquitos can be effectively controlled.

WORTH (H. N.) & SUBRAHMANYAM (K.). **Anti-larval Flushing of Rivers and Streams in Ceylon.**—*J. Malar. Inst. India* **3** no. 1 pp. 81–92, 2 pls., 3 figs., 4 refs. Calcutta, 1940.

In order to be in a position to supplement the measures already being carried out in Ceylon to reduce the breeding of *Anopheles culicifacies*, Giles, in the beds of rivers and streams [*cf. R.A.E.*, B **25** 168], observations and experiments are being undertaken on the construction and operation of siphon dams for automatic flushing. Two types are described, the second being a modification of the first. Both are made of concrete in standardised units, so that the number used may be varied according to the width of the stream, and are strong enough to withstand damage by floating logs during times of flood. They are made on the spot and are designed to form part of the dam and so to avoid additional construction in the dam wall.

Observations were made on the physical effects of flushing in terms of height and width of the flush at various distances from the siphon and the velocity of the current before and during flushing. The probable effects on the larvae were indicated by means of confetti scattered along the margins of rivers and pools at measured distances both upstream and downstream from the siphons. The results suggested that over a distance of 4,900 feet downstream more than 90 per cent. were destroyed ; this figure showed very slight variations on all sections. The flush was considered effective in preventing excessive breeding for distances of between $\frac{1}{2}$ and $\frac{3}{4}$ mile. Where the streams broadened out above the dam, the percentage of the confetti stranded averaged 50, but in deep and narrow reservoirs less than 10. Although gradually drawn towards the siphon, the confetti was not drawn into it and remained floating in deep water ; living larvae would undoubtedly have kept to the shallow water at the margins, and it is improbable that any appreciable number would pass a siphon under natural conditions. On the other hand, breeding upstream was reduced by the elimination of isolated pools over the extensive stretch forming the reservoir. Records of surface velocity made at the same time as regular dippings indicated that a velocity of from $1\frac{1}{2}$ to $1\frac{3}{4}$ ft. per second would suffice to reduce marginal breeding to a

minimum in rivers with a bed formed mainly of rocks. A table is given showing the area of siphon opening necessary to give this velocity when working with a head of from 40 to 25 inches on streams of various widths and slopes so that control over a distance of 5,000 feet below the dam may be obtained.

RAMSAY (G. C.) & ANDERSON (I. R.). **An Investigation on the Use of automatic Siphon Sluices on a Group of Tea Estates in Northern Bengal.**—*J. Malar. Inst. India* **3** no. 1 pp. 93–97, 2 refs. Calcutta, 1940.

A brief account is given of trials undertaken in 1939 with a type of automatic siphon sluice designed for use on estates in Ceylon [*R.A.E.*, B **27** 207], with a view to eliminating the necessity for supervision of flushing by means of the hand-operated sluices or the recurring expenditure of oiling schemes that are at present employed for the control of *Anopheles minimus*, Theo. Rainfall in northern Bengal differs greatly in amount and distribution from that normally prevailing in Ceylon or Malaya; the average amount is about twice as great, and instead of being distributed more or less evenly, as in Malaya, most of it falls during the period of the south-west monsoon (June–September). Since the discharge rate of the Ceylon siphon proved insufficient, a "Dooars" siphon was constructed on similar lines but with four times the capacity. Two of these siphons were installed in a channel 8 feet wide; they were raised about 3 feet above the bed of the channel in order to form a large reservoir. They discharged over 100,000 gallons of water in half an hour at intervals of 3 hours, and throughout the season no larvae of *A. minimus* were found within $1\frac{1}{2}$ miles below the dam. The use of these siphons should be of great value, especially on estates which abut on land outside their jurisdiction, since breeding of *A. minimus* could then be prevented by flushes originating on the estates. The cost of constructing and installing the siphons is discussed; for two siphons this was approximately the annual cost of oiling a channel (where breeding is now being controlled by flushing), so that recurrent expenditure is more or less eliminated.

IYENGAR (M. O. T.). **Further Observations on Vectors of Malaria in Bengal and Notes on the Seasonal Infectivity of Anopheles.**—*J. Malar. Inst. India* **3** no. 1 pp. 115–123, 2 refs. Calcutta, 1940.

In continuation of previous work on malaria infection in Anophelines in Bengal [*R.A.E.*, B **27** 209], 11,425 specimens belonging to 16 species were examined. Natural infections were found in *Anopheles philippinensis*, Ludl., *A. minimus*, Theo., *A. sundaicus*, Rdnw., *A. annularis*, Wulp, and *A. varuna*, Iyen., the infection rates being 6·3, 18·6, 15·8, 0·04 and 0·2 per cent. and the sporozoite rates in the first three 3·9, 9·3 and 5·3. These first three species are the important vectors in the plains, the submontane zone and the estuarine regions, respectively. Analysis of the findings relating to *A. philippinensis* and *A. minimus* showed that the incidence of infection varied in different months. Infection in the former was observed from May to February, and was highest from September to November. Data for the latter, which are available for 9 months only, indicated that

infection rates were high during June–September. In an appendix are given the localities and dates in which collections were made, the numbers of each species examined and the results obtained.

CAPON (P. J. L.). **A brief Investigation regarding the Height above Sea-level at which Malaria occurs in Baluchistan.**—*J. Malar. Inst. India* **3** no. 1 pp. 125–127. Calcutta, 1940.

An outbreak of malaria occurred in July 1939 among British troops in a camp in Baluchistan at 6,500 ft. above sea level, an altitude previously considered too great to permit the transmission of the disease. Examination of the populations of villages in the vicinity showed that malaria is highly endemic at 6,500 ft. ; it does not appear to exist at a village at 8,000 ft. or in a locality in China 6 miles distant at 7,250 ft. The chief vectors in Baluchistan are *Anopheles superpictus*, Grassi, which is a strong flyer well-adapted to resist the extremes of climate of the country, and *A. culicifacies*, Giles, but during the investigation no mosquito breeding was observed.

WATS (R. C.) & BHARUCHA (K. H.). **The Choice of Mechanical Sprayers for Mosquitocides sprayed for Antimalarial Purposes.**—*J. Malar. Inst. India* **3** no. 1 pp. 129–136, 1 pl., 7 refs. Calcutta, 1940.

It has been suggested that the greatest handicap to the use of sprays against Anophelines in dwellings as an anti-malarial measure is the unsuitability of the apparatus available for applying the insecticide in village huts or inhabited rooms, which cannot be made air-tight and must therefore receive the maximum concentration necessary to kill the mosquitos in the minimum amount of time. The De Vilbiss paint sprayer has been found satisfactory when an air pressure of more than 15 lb. per square inch is used [*cf. R.A.E.*, B **28** 93]. Obvious requirements are that the pressure is more than can be obtained from a hand pump, that the nozzle produces a spray fine enough to mix intimately with the air in the room, and that there is no wastage by dripping from the nozzle either at the beginning or end of the operation. It is therefore necessary to use power-driven air-compressor outfits, to maintain an exact relationship between the air and liquid orifices in the nozzle and to provide a nozzle that does not begin to eject the liquid until the air pressure is sufficient to produce a good spray and ceases to do so before the air pressure drops too low to make a good spray possible.

The tests briefly described in this paper were carried out with various types of apparatus available in Bombay, details of which are given. Small cubical mosquito-netting cages containing mixed batches of adult mosquitos caught in stables and houses, most of which were *Armigeres obturbans*, Wlk. (a hardy Culicine that needs 50 per cent. greater concentration of pyrethrum extract for a total kill as compared with the local species of Anophelines), were placed in a room in which the well-fitting door and two windows were closed but no especial precautions were taken to make it air-tight. The cages, which were kept under a table during the actual spraying, were afterwards suspended from the ceiling at different levels for half an hour and then rapidly removed to an open room, where a petri dish containing cotton wool soaked in glucose was placed in each and they were left overnight ;

the mortalities were recorded on the following morning. The insecticide chiefly used was Pyrocide 20 [*cf. loc. cit.*]. From the results, which are summarised in a table, it is concluded that the AMCO Atomizer no. 4, or a spray-gun with a power-driven compressor outfit, can be recommended for large-scale operations.

AFRIDI (M. K.), MAJID (S. Abdul) & PRASAD (V.). **Observations on the Range of Dispersion of *Culex fatigans* and its Infiltration into the Delhi Urban Area. Part II.** —*J. Malar. Inst. India* **3** no. 1 pp. 143–152, 1 diagr., 1 chart, 2 maps, 2 refs. Calcutta, 1940.

Observations on *Culex fatigans*, Wied., and its invasion of the Delhi Urban Area were continued in 1938 and 1939 [*cf. R.A.E.*, B **26** 232]. Figures for mosquito collections in 1938 were affected by intensive anti-larval measures instituted over a section of the sewage farm bordering on New Delhi, and those for 1939 by the fact that towards the end of 1938 the farm was abandoned and replaced by an aeration plant installed 6 miles further away. Observations on the density of larvae in the various types of breeding places in an uncontrolled section of the farm carried out from March to June 1938 showed that heavy breeding occurred consistently in shaded and stagnant collections of water, such as grass plots, lagoons with horizontal vegetation, etc., and no breeding took place in moving water. Control measures were devised, therefore, to eliminate stagnant water and to remove shade by clean weeding. The trap collections made in different sections of New Delhi in 1937 and 1938 showed that during 1938 the mosquito population declined markedly in the area nearest to the sewage farm, whereas there was no apparent diminution in the Central Vista. Since no local breeding was detected, it was believed that the mosquitos had immigrated from a village where no control measures were undertaken in that year. This view was confirmed by the decrease observed in mosquito collections made in 1939 after the sewage farm had been abandoned and control measures had been extended to the village and its surroundings. The probable reason why mosquitos were numerous in the Central Vista and scarce in two other roads at practically the same distance from the village is the attraction exercised by the presence in the former of large expanses of water associated with a localised increase in humidity and decrease in temperature. The effect of temperature and humidity on the numerical prevalence of *C. fatigans* is discussed; an increase was significantly correlated with the former, but not with the latter. A rapid decline in numbers was associated with rises in the minimum and maximum temperatures above 72 and 100°F., respectively.

RUSSELL (P. F.) & RAO (T. Ramachandra). **On Habitat and Association of Species of Anopheline Larvae in South-eastern Madras.**—*J. Malar. Inst. India* **3** no. 1 pp. 153–178, 10 pls., 3 charts, 4 refs. Calcutta, 1940.

In connection with an investigation on malaria [*cf. R.A.E.*, B **27** 44] an intensive survey of Anopheline larvae was carried out in the town and taluk of Pattukkottai during 1937 and 1938, and the results are shown in a number of tables; 141,119 larvae belonging to 12 species were taken in 5,616 collections. *Anopheles culicifacies*, Giles, which is the vector of malaria in this region, was the commonest species and

occurred in breeding places of all types [*cf. loc. cit.*], 49,129 larvae being taken in 3,190 collections. Several types of breeding places are briefly described. The data given show the breeding places of each species, its prevalence and its associations with other species.

Menon (M. A. U.). **A Description and Comparative Study of the Fourth Instar Larvae of** *Mansonia* (*Mansonioides*) *uniformis* **(Theobald), and** *Mansonia* (*Mansonioides*) *annulifera* **(Theobald), including a Synoptic Table for the Identification of the Larvae of the Indian Species of the Subgenus** *Mansonioides* **Theobald, 1907 (Diptera, Culicidae).**—*J. Malar. Inst. India* **3** no. 1 pp. 179–184, 3 pls., 6 refs. Calcutta, 1940.

The following is the author's summary : The fourth-instar larvae of *Mansonia* (*Mansonioides*) *uniformis*, Theo., and *M.* (*M.*) *annulifera*, Theo., are described in detail and the important diagnostic characters of the two species summarised in a table. A synoptic table based on the present study and the description of the fourth-instar larvae of *M. indiana*, Edw., and *M. longipalpis*, Wulp, published by Rodenwaldt [*R.A.E.*, B **23** 23] and Bonne-Wepster [**27** 187], respectively, is drawn up to differentiate the four species of *Mansonioides* prevalent in India.

Chopra (R. N.), Roy (D. N.) & Ghosh (S. M.). **Insecticidal and Larvicidal Action of** *Tephrosia vogelii*.—*J. Malar. Inst. India* **3** no. 1 pp. 185–189, 4 refs. Calcutta, 1940.

In view of the fact that acetone extracts of the seeds of *Tephrosia vogeli* from Assam have proved to be effective against Anopheline larvae [*R.A.E.*, B **27** 208], the tests briefly described in this paper were undertaken to determine the effect on various insects, chiefly mosquitos and mosquito larvae, of the leaves of this plant and extracts prepared from them from the same part of India. No effective results were obtained with powdered dried leaves or extracts made with water or kerosene, and acetone extracts did not affect adult mosquitos. Complete mortality of larvae of *Anopheles*, *Culex* and *Aëdes* was obtained in 24 hours with a 1 in 10 dilution of an extract made with acetone, but it could not be used for practical work owing to the high cost of the acetone.

Barretto (M. P.). **Observações sôbre a ecologia dos anofelinos do grupo** *Nyssorhynchus* **(Diptera, Culicidae). I. O** *Anopheles* (*N.*) *strodei* **Root, 1926, o** *A.* (*N.*) *argyritarsis* **Rob. Desv., 1827 e o** *A.* (*N.*) *albitarsis* **Arribálzaga, 1877 de Palmeiras, Estado de S. Paulo.**—*Rev. Ent.* **11** fasc. 1–2 pp. 159–172, 6 refs. Rio de Janeiro, 1940. (With a Summary in English.)

An account is given of observations made from October to December 1938 in São Paulo, Brazil, on the ecology of Anophelines of the *Nyssorhynchus* group. Information on *Anopheles darlingi* var. *paulistensis*, Galvão, Lane & Corrêa, has already been noticed from a fuller account [*R.A.E.*, B **27** 227]. *A. albitarsis*, Arrib., *A. argyritarsis*, R.-D., and *A. strodei*, Root, comprised 5·15, 0·65 and 10·90 per cent. of the 156 mosquitos caught in dwellings, and 2·00, 3·50 and 24·25 per cent. of the 400 caught in a Magoon trap baited with a horse [*cf.* **27** 228]. Of 1,000 larvae taken from various breeding places, *A. d. paulistensis*

[*cf. loc. cit.*], *A. strodei*, *A. argyritarsis*, *A. albitarsis* and *A. pessôai*, Ayroza Galvão & Lane, comprised 40·4, 6·9, 34·5, 18·0 and 0·2 per cent.

At laboratory temperatures between 19·4 and 28·2°C. [66·92 and 82·76°F.], the egg, larval and pupal stages of *A. strodei* lasted a minimum of 2, 11 and 2 days, respectively. The larvae were most numerous in small, open, sunlit collections of water with abundant algae and organic detritus. In such breeding places, they were usually associated with *A. argyritarsis* and rarely with *A. albitarsis*. They seldom occurred in typical breeding places of *A. d. paulistensis*. The temperature of the water in which they were found varied between 17·4 and 31·2°C. [63·32 and 88·16°F.]. The pH ranged from 5·9 to 7·2, and was 6·8–7·1 in the most populated breeding places.

A. argyritarsis was most active after sunset, but two examples were observed attacking man in full sunlight near a breeding place. The larvae occurred mostly in shallow pools, small overflows and puddles in marshy ground that were sunlit and contained algae and organic detritus, and were also taken in disused drainage channels and hoof-prints. They were rare in typical breeding places of *A. d. paulistensis*. The temperature of the water ranged from 16·6 to 33·2°C. [61·88 to 91·76°F.] and in one typical breeding place from 20·3 to 31·5°C. [68·54 and 88·7°F.] in the course of one day. The pH varied between 5·8 and 7·5, and was 5·8–6·6 in the most populated breeding places.

Of the adults of *A. albitarsis* caught in houses, 75 per cent. were taken by night. They were most active after sunset, but one female was observed attacking man near a breeding place by day. Most of the larvae occurred in small side bays and along the edges of a dam shaded by trees, where aquatic vegetation was scanty and algae and detritus scarce. The water had a temperature of 17·5–31·5°C. [63·5–88·7°F.] and a pH of 6·1–7·4 (6·8–7·4 in the most populated breeding places).

Ayroza Galvão (A. L.) & Coutinho (J. O.). **Contribuição ao estudo dos flebótomos de São Paulo. Dipt. 1a Nota.** [A Contribution to the Study of the *Phlebotomus* of São Paulo. 1st Note.]—*Rev. Ent.* **11** fasc. 1–2 pp. 427–440, 2 pls., 22 figs., 11 refs. Rio de Janeiro, 1940. (With a Summary in English.)

In connection with an investigation in the State of São Paulo of the epidemiology of leishmaniasis of the skin and mucous membranes [espundia] caused by *Leishmania brasiliensis*, observations were carried out on the incidence of *Phlebotomus* in severely infected regions. Nearly 7,000 sandflies were taken during May-October 1939 by means of human and animal (dog) bait, mostly during the night. The species taken, of which the numbers, seasonal incidence and food-preferences are given, comprised *P. whitmani*, Antunes & Coutinho, *P. migonei*, França, and *P. fischeri*, Pinto, which were by far the commonest and were taken mostly in September and October, and *P. limai*, Fonseca, *P. intermedius*, Lutz & Neiva, and *P. brumpti*, Larrousse, which were rare. *P. whitmani* and *P. migonei* both preferred dog to man, but the former was taken more frequently on man than the latter, while *P. fischeri*, which was less common, preferred man to dog.

Keys are given to the adults of both sexes of the species of *Phlebotomus* that occur in Brazil, together with a list showing the States in which they have been recorded, and the spermathecae of the females of some of them are figured.

CALLAWAY (S.) & MUSGRAVE (A. J.). **Laboratory Tests with Liquid Insecticides on the Eggs of the Bed-Bug,** *Cimex lectularius* **L.**—*Ann. appl. Biol.* **27** no. 2 pp. 252 261, 10 figs., 20 refs. London, 1940.

The following is based on the authors' introduction, summary and conclusions: This paper contains descriptions of detailed laboratory tests in which dodecyl thiocyanate (lauryl rhodanate), α-naphthyl-isothiocyanate, β-butoxy-β′-thiocyanodiethylether (*n*-butyl-carbitol-thiocyanate) and pyrethrins were compared as sprays in a highly refined kerosene-type oil against eggs of *Cimex lectularius*, L. The results are expressed as regression lines obtained by Bliss' probit method [*cf. R.A.E.*, A **22** 440; **23** 493] and, where possible, as relative potencies. They indicated that 3 per cent. butyl-carbitol-thiocyanate is superior to 3 per cent. α-naphthyl-isothiocyanate, 3 per cent. lauryl rhodanate, 0·4 per cent. pyrethrins or a mixture of 1 per cent. butyl-carbitol-thiocyanate and 0·1 per cent. pyrethrins. Evidence suggests that butyl-carbitol-thiocyanate differs in its mode of action from lauryl rhodanate and the pyrethrins. A Potter spraying tower was used [B **28** 150], and an attempt made to administer an accurately known dosage of insecticide is described, but it is concluded that when this spraying tower is used to test insecticides with a light oil base it is essential to maintain full control over the dosage administered by weighing the amount of spray deposited at the time of the experiment. This probably applies to all types of testing apparatus. The eggs of *C. lectularius* are unsuitable material for routine insecticide tests, as they are very difficult to obtain in a condition suitable for randomisation, and their true age is sometimes doubtful.

MUSGRAVE (A. J.). **Some Experiments with certain Liquid Insecticides in Houses infested with the Bed-Bug,** *Cimex lectularius* **L.**—*J. Hyg.* **40** no. 4 pp. 462–473, 5 figs., 6 refs. London, 1940.

An account is given of experiments in which several small unoccupied houses under a demolition order, a larger unoccupied house and an occupied one were sprayed for the control of *Cimex lectularius*, L., with β-butoxy-β′-thiocyanodiethylether [*n*-butyl-carbitol-thiocyanate], which has been shown to have a marked toxic effect on the eggs [*R.A.E.*, B **28** 150] and has recently been found superior as an ovicide to a number of other compounds [see preceding abstract]. It was used in the form of Lethane 384 [*cf.* **27** 251], and since these tests, it has been employed in commercial practice. Solutions of pyrethrins and mixtures of the two were also tested. The insecticides were sprayed in oil carriers on to the internal fabric of the buildings, special attention being given to cracks, and the upper rooms and stairs received heavier applications than the other parts of the house. Very loose wallpaper was torn off, and on a few occasions wood fittings were eased or removed. The houses were not sealed. The most economical method of applying the spray seemed to be to use an ordinary "hand sprayer" similar to that used by horticulturists and giving a continuous spray. The effectiveness of the treatment was estimated by crawling round the rooms, collecting the dead bugs and counting the living ones, which were left in position. More than 2,000 dead bugs were found in one small house. The thiocyanate was tried in four different oil carriers

and gave good results as a 3 per cent. solution (6 per cent. Lethane), a concentration at which there is no danger to health. A pyrethrum preparation in a heavy oil (0·13 per cent. pyrethrins) also showed promise, and a mixture of the two (0·065 per cent. pyrethrins and 1 per cent. thiocyanate) was effective. Usually, about 1 gal. of spray was used for one application for a two bed-roomed house, and 1–5 applications were made per house.

Lewis (E. A.). **The Ticks of East Africa. Pt. I. Species, Distribution, Influence of Climate, Habits and Life-histories.**—*Emp. J. exp. Agric.* **7** no. 27 pp. 261–270. Oxford, 1939. **Pt. II. Tick-borne Diseases and their Control.**—*T.c.* no. 28 pp. 299–304, 6 refs. [Recd. 1940.]

In the first part of this paper, it is stated that ticks provided one of the most serious problems of stock raising in East Africa for pioneer settlers, and moreover hindered the development of native reserves and agriculture and the improvement of indigenous stock, and tick-borne diseases necessitate the restriction of the movement of cattle. A list is given of the ticks of British East Africa (Kenya, Tanganyika and Uganda), which comprise upwards of 70 species or subspecies. Little is known of many of them, but at least 18 transmit disease. The broad outlines of the distribution of the various species in East Africa are given, but they are not adequate as a guide to a programme of tick eradication. The relation between the climate there and the activity and survival of the ticks is discussed. Illustrations are given of the adaptability of many of them to different hosts, and the habits and life-histories of the various groups of ticks in East Africa are briefly reviewed. Attention is drawn to the fact that in the case of many species there is much in the host-parasite relation that is not understood.

In the second part of the paper, a table is given showing the tick-borne diseases of man and animals that occur in East Africa, with the host or hosts, causal organism and vector or vectors of each. Every species of domestic animal in East Africa is subject to one or more tick-borne diseases. The stages in which the ticks can acquire and transmit some of them are given. Mention is made of a number of non-specific or less specific diseases and abnormal conditions associated with or caused by ticks. Examples are given of aspects of the subject of disease transmission by ticks about which much is not yet known. Control of ticks in East Africa involves all classes of domestic animals and, in some districts, a consideration of game, birds and vermin as well. Various control measures are discussed, and it is pointed out that where farms are well fenced and dipping has been practised with regularity, ticks have been eradicated even in the midst of heavily infested country. The intervals at which dipping against various species of ticks should be repeated are given.

Gunn (W. R.). **Report of the Live Stock Branch.**—*Rep. Dep. Agric. Brit. Columbia 1938* **33** pp. L98–L105. Victoria, B.C., 1939. [Recd. 1940.]

In the course of this Report, it is stated that treatment with derris dust, which has proved very effective against *Dermacentor albipictus*, Pack., on horses in British Columbia, has also given promising results against *D. andersoni*, Stiles, on sheep and cattle [*cf. R.A.E.*, B **26** 23],

although its complicated life-history renders control more difficult. When well brushed into the roots of the hair over the head, neck, shoulders and back of the animals, the dust forms a repellent layer on which the ticks will not remain. Cattle should be treated before they are moved to infested ranges and before the ticks become abundant ; one treatment appears enough to protect them until they are moved on to the uninfested summer range lands. In one or two instances ticks were reported to have been killed by the dust, even where firmly attached. Some difficulty was encountered in applying the dust to heavy-coated cattle, on which, however, it formed a very complete layer, and to sheep in full fleece, where the problem should be eliminated by the practice, now generally adopted, of earlier shearing.

Rees (C. W.) & Avery (J. L.). **Experiments on the Hereditary Transmission of Anaplasmosis by Ticks.**—*N. Amer. Vet.* **20** no. 12 pp. 35–36, 5 refs. Evanston, Ill., 1939. [Recd. 1940.]

It has been shown experimentally in the United States that anaplasmosis of cattle can be transmitted by examples of *Rhipicephalus sanguineus*, Latr., *Dermacentor variabilis*, Say, and *D. andersoni*, Stiles, that have engorged on infected animals in the previous stage [*R.A.E.*, B **19** 66 ; **20** 136 ; **21** 70]. In nature, however, larvae and nymphs of the two species of *Dermacentor* occur on rodents, which are refractory to the disease, so that if anaplasmosis is transmitted by these ticks, it must be passed from the adults through the immature stages to the adults of the succeeding generation [but *cf.* **28** 217] as it is known to be in another tick [**22** 164]. Attempts were therefore made to obtain transmission of the disease by the offspring of adults of *D. andersoni*, *D. variabilis*, *Otocentor* (*D.*) *nitens*, Neum., and *R. sanguineus* that had been allowed to engorge completely on infected cattle. *O. nitens*, a one-host tick obtained from Porto Rico, was included at the suggestion of B. Schwartz, who commonly observed the adults on cattle in that Island. All the results were negative, although, with the exception of one experiment in which the larvae and nymphs of *R. sanguineus* engorged on rabbits, the ticks engorged successively as larvae, nymphs and adults on susceptible cattle.

Sen (P.). **A Note on some Ectoparasites of Poultry and their Control.**—*Indian J. vet. Sci.* **10** pt. 2 pp. 218–222, 6 figs., 1 ref. Delhi, 1940.

A severe outbreak of lice occurred during early March 1938 on the poultry farm at Latoli of the Imperial Veterinary Research Institute, Mukteswar. Infestation was so intense that one bird died within two hours of its arrival at the laboratory, before any treatment could be given. Inspection of the farm showed that almost every bird in the poultry house was infested with lice, which were prevalent in all stages of development, and were identified as *Eomenacanthus* (*Menopon*) *stramineus*, Nitz. The eggs of this species are laid in compact batches of several hundred on the base of the feathers. At least three nymphal instars were observed. These and the adult are described. The lice feed on the barbules of the feathers, completely removing the latter in some places. Scrapings from the legs of certain birds that had scales showed the presence of *Cnemidocoptes mutans*, Rob. & Lanq., larvae and adults of which were observed to exist

simultaneously on the same bird. They are briefly described. Post-mortem examination of a bird that had died as a result of infestation by lice revealed the presence of some individuals of the air-sac mite, *Cytoleichus nudus*, Vizioli [*cf. R.A.E.*, B **26** 90]. The fowls were freed of both lice and *Cnemidocoptes mutans* by immersing them for about two minutes in a bath containing a 0·5 per cent. solution of commercial sodium fluoride. Care was taken to hold their heads out of the solution, and after treatment, they were wiped and kept in the sun to dry. To treat 7 birds, 1½ oz. sodium fluoride in 2 gals. tepid water was sufficient. The yard of the fowl house was cleaned by burning hay over it, and the house was cleaned and washed with a disinfectant.

ALICATA [J. E.]. **Life Cycle of Pinworm,** *Subulura brumpti.—Rep. Hawaii agric. Exp. Sta. 1939* p. 67. Honolulu, 1940.

Two common pinworms parasitise the caeca of fowls in Hawaii. One of them, *Heterakis gallinae*, requires no intermediate host; the life-cycle of the other, *Subulura brumpti*, was studied during 1938–39. Embryonated eggs of the parasite are ingested by an intermediate host, and the larvae develop to the stage infective to fowls in about 15 days. Intermediate hosts have been found under natural conditions to be the earwig, *Anisolabis* (*Euborellia*) *annulipes*, Lucas, and the beetles, *Dermestes vulpinus*, F., *Dasus* (*Gonocephalum*) *seriatus*, Boisd., *Ammophorus insularis*, Boh., and *Alphitobius diaperinus*, Panz. Under experimental conditions, grasshoppers (*Conocephalus saltator*, Sauss.) have also been found to be possible carriers. The larvae reach maturity in the caeca of the birds about 36 days after ingestion of infected insects by the fowls.

BLANC (G.) & BALTAZARD (M.). **Comportement du virus du typhus épidémique chez la puce du rat** *Xenopsylla cheopis.—Bull. Acad. Méd.* (3) **123** no. 7–8 pp. 126–136, 14 graphs, 5 refs. Paris, 1940.

Experiments by various workers on the problem of the relation of epidemic and murine typhus and the possibility that one can be transformed to the other as a result of a change in the vector [*cf. R.A.E.*, B **20** 244–246; **22** 100; **23** 187] have led the authors to believe that the host cycle of rickettsiae is not so rigidly specific as has previously been supposed. They have therefore undertaken experiments with epidemic and murine typhus in which ectoparasites are exposed to an infection with which, by reason of their habitat or bionomics, they are apparently not associated in nature. For a strain of typhus to be considered adapted to an insect host, they consider it necessary that the virus should be picked up in one infecting feed, persist in the insect throughout its life, multiply and not merely survive in the digestive tract, and above all, be present and survive in the excreta. They have already shown that murine typhus can be transmitted through the donkey and *Haematopinus asini*, L. [**28** 129].

This paper contains an account of experiments with epidemic typhus and many thousands of individuals of *Xenopsylla cheopis*, Roths. The fact that the flea could become infected by biting guinea-pigs inoculated with the virus, and that the virus recovered from the flea was unchanged, was first verified. The experiments showed that a single feed is sufficient to infect the fleas, in which the virus appears after 24–48 hours. The fleas retained the virus throughout life and

did not suffer any ill effects. Its retention showed that it multiplied in them. It was present in the excreta throughout the life of the infected flea and remained infective in dry excreta for at least 100 days. The infection of *X. cheopis* with epidemic typhus was thus comparable with those, classed as specific, of the louse [*Pediculus humanus*, L.] with the same virus and of the flea with murine typhus.

It is pointed out that although fleas, even *Pulex irritans*, L., are not such strict or numerous parasites of man as lice and that their habits, unlike those of the louse, usually lead them to deposit their excreta away from man, it is nevertheless possible that they may play a part in the transmission or maintenance in an endemic form of the virus of epidemic typhus in nature. Moreover, the question of an animal reservoir must once more be considered.

PAPERS NOTICED BY TITLE ONLY.

KÔNO (H.) & TAKAHASI (H.). **A Revision of the** *Culicoides*—**Species of Saghalien** [Sakhalin] **and Hokkaido (Ceratopogonidae, Diptera)** [including 2 new species from Japan and 1 from Sakhalin]. —*Insecta matsum.* **14** no. 2–3 pp. 69–77, 5 figs. Sapporo, 1940.

KÔNO (H.) & TAKAHASI (H.). **Die Simuliiden von Sachalin und Hokkaido.** [The Simuliids of Sakhalin and Hokkaido.]—*Insecta matsum.* **14** no. 2–3 pp. 79–82. Sapporo, 1940.

BEQUAERT (J.). **The Tabanidae of the Antilles (Dipt.)** [including new species].—*Rev. Ent.* **11** fasc. 1–2 pp. 253–369, 33 figs., 1 map. Rio de Janeiro, 1940.

LANE (J.) & COUTINHO (J. O.). *Mansonia* **subg.** *Rhynchotaenia*: **Descrição de duas espécies novaes e dados sobre o subgênero (Dipt. Culicidae).** [*Mansonia* subg. *Rhynchotaenia*. Description of two new Species from Brazil and Data on the Subgenus (including keys to the Brazilian species).]—*Rev. Ent.* **11** fasc. 1–2 pp. 589–597, 12 figs., 5 refs. Rio de Janeiro, 1940. (With a Summary in English.)

VARGAS (L.). **Clave para identificar algunos géneros de mosquitos americanos, utilizando los caracteres de los adultos.** [A Key to some Genera of American Mosquitos (including all those known in Mexico), using the Characters of the Adults.] —*Rev. Inst. Salub. Enferm. trop.* **1** no. 2 pp. 189–198, 10 refs. Mexico, D.F., 1940. (With a Summary in English.)

VARGAS (L.). **Clave para identificar las hembras de** *Anopheles* **mexicanos.** [A Key to the Females of Mexican *Anopheles*.]— *Rev. Inst. Salub. Enferm. trop.* **1** no. 2 pp. 199–203, 4 refs. Mexico, D.F., 1940.

KOBAYASI (H.). **On the Development of** *Microfilaria* [*Filaria*] *bancrofti* **in the Body of the Mosquito,** *Culex fatigans*.—*Acta jap. Med. trop.* **2** no. 1 pp. 63–88, 4 pls., 2 figs., 25 refs. Taihoku, Formosa, 1940.

FRAENKEL (G.). **Utilization and Digestion of Carbohydrates by the Adult Blowfly** [*Calliphora erythrocephala*, Mg.].—*J. exp. Biol.* **17** no. 1 pp. 18–29, 17 refs. London, 1940.

JOHNSON (C. G.). **The Maintenance of High Atmospheric Humidities for Entomological Work with Glycerol-water Mixtures.**—*Ann. appl. Biol.* **27** no. 2 pp. 295–299, 2 figs., 4 refs. London, 1940.

YAMASHITA (J.). **Studies of Ticks found in Manchoukuo. I. On two Species of Tick from Cattle at the Yamuyingtzu Stock-farm, near Wangyehmiao, Inner Mongolia, Manchoukuo.** [*In Japanese.*]—*Jap. J. vet. Sci.* **1** pp. 602–609, 2 pls., 12 refs. 1939. (With a Summary in English.) (Abstr. from English Summary in *Vet. Bull.* 10 no. 9 pp. 679–680. Weybridge, 1940.)

Piroplasmosis of cattle is very common in Manchuria, but the vector has not been recorded. The author, in a search for possible vectors, found two species of ticks, *Dermacentor reticulatus*, F., and *Hyalomma detritum albipictum*, Schulze, on 105 out of 324 cattle examined, chiefly on the dewlap and inner sides of the hind legs.

STALEY (J.). **A Species of Mosquito (Diptera, Culicidae) new to Britain.** *Nature* **146** no. 3698 p. 368. London, 1940.

On 20th and 21st August 1940, third- and fourth-instar larvae of *Theobaldia longiareolata*, Macq., which has not previously been recorded in Britain, were collected at Portsmouth from a small pool of rather foul, slightly saline water at the silted-up end of a moat where a mixed collection of rubbish had been discharged. A pupa of *Anopheles claviger*, Mg., and larvae and pupae of several other mosquitos were collected with them.

MARKS (E. N.). **Habits and Chaetotaxy of the Larva of** *Anopheles atratipes* **Skuse.**—*Proc. roy. Soc. Qd* **51** pt. 1 pp. 19–23, 1 pl., 3 refs. Brisbane, 1940.

The larva of *Anopheles atratipes*, Skuse, was first found by Mackerras on Stradbroke Island, Queensland, in September 1926, and recorded by him in a paper already noticed [*R.A.E.*, B **16** 29]. During September and October 1938, larvae of the same species were collected from Nudgee, Redcliffe, and Bribie Island, Queensland. At Nudgee, they were found in a sluggish, slightly muddy creek with little vegetation, a habitat corresponding to that from which they were originally taken ; at Redcliffe, they occurred in a fresh-water swamp of tea-trees (*Melaleuca* spp.) with considerably more vegetation, and at Bribie Island in water lying in small depressions in damp, peaty soil under tea-trees. In all cases, larvae of *Anopheles annulipes*, Wlk., and *Culex annulirostris*, Skuse, were found in the same habitat. In view of important divergences between the characters of the larvae as observed by the author and as described by Mackerras, a full account is here given of the larval chaetotaxy.

PACKCHANIAN (A.). **Experimental Transmission of** *Trypanosoma cruzi* **Infection in Animals by** *Triatoma sanguisuga ambigua*.—*Publ. Hlth Rep.* **55** no. 34 pp. 1526–1532, 2 pls., 13 refs. Washington, D.C., 1940.

During the summer of 1936, the author found *Triatoma sanguisuga ambigua*, Neiva, at Sarasota, Florida, and examination of various collections showed that occasional examples have been taken from several other towns and cities in the State. At Sarasota, the bugs were found to feed on tree toads of the genus *Hyla*, which congregate under the leaf-stalks of palmetto trees. Most of the tree toads were naturally infected with *Haemogregarina*, but all were free from

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Trypanosoma rotatorium. Several hundred palmetto trees near which there were no tree toads were examined in Florida and Georgia, but the bug was not found. Over 50 persons are known to have been bitten by it in the summer of 1936. The bites are usually painless at first, but after a few hours a moderate erythema develops, followed by itching, and in about 12 hours there is a definite macule, and after 48 hours a papule with inflammation which remains for about 3 days, causing varying degrees of pain and itching. Samples of blood from 10 persons who developed the above symptoms after being bitten by bugs were shown to be negative for *Trypanosoma cruzi*. The faecal matter from 300 live bugs from Sarasota and the saliva of 25 were found to be negative for trypanosomes. It is pointed out in a footnote that there is no known reservoir host of *T. cruzi* in Sarasota from which the bugs might acquire infection.

Under laboratory conditions, older individuals fed readily on various animals, but newly-hatched ones fed only on delicate skin and easily accessible blood vessels, such as occur in small frogs and in the tails of mice. When 24 adults collected in Florida and apparently free from infection with *T. cruzi* and 61 non-infected nymphs and adult males and females reared in the laboratory were fed on infected guineapigs, all became infected. The experiments were carried out in six groups, two of which are described as representative. In both, infection was maintained in the intestines throughout life. The eggs were free from trypanosomes, and nymphs hatching from these eggs and fed on healthy animals showed no evidence of infection. When bugs experimentally infected with *T. cruzi* were allowed to feed on a guinea-pig, but care was taken that no faecal matter from them came in contact with the skin of the animal; they did not transmit the infection. Experimentally infected bugs allowed to feed and then deposit faecal excretion, which was heavily infected, on the clipped skin of two healthy guineapigs transmitted *T. cruzi* to them.

SHUTE (P. G.). **A Species of Mosquito infesting deep Shelters in London.**—*Lancet* **240** no. 6123 pp. 6–7, 1 ref. London, 1941.

In the autumn of 1940, many people using the underground stations in London as air-raid shelters at night complained of being bitten by mosquitos. A search of the dark parts of the system revealed the presence of numerous adults of *Culex pipiens molestus*, Forsk., many of them gorged with blood. It was first thought that they had come from above ground and were seeking cold, damp hibernation quarters, but examination showed that the females were without adipose bodies, and a few days later, at the end of November, males were found. This showed that breeding was still in progress. Breeding places were found to be fairly numerous over a wide area, and were usually in the excavations below the lines and under main platforms at various stations. In most cases, the water was only a few inches deep, but often extended for 100 yards. Larvae were abundant. It is obvious that temperature alone is necessary to prevent this species going into hibernation, as there is no lighting in the passageways where the larvae were developing. Under peace-time conditions, the opportunities for the mosquitos to obtain a blood meal would be small, but they are great while the tubes are being used as shelters at night. There is a complete absence of natural enemies in the breeding grounds. In many parts of the tubes, the atmospheric temperature exceeds 70°F.,

even when it is freezing outside, so that breeding can proceed continuously throughout the year. So far as is known, this is the first time that this has been found to occur in nature among British mosquitos. If all breeding places are treated with cresol or paraffin, there should be no difficulty in ridding the tubes of the mosquito, and steps have been taken to ensure this.

SINTON (J. A.) & SHUTE (P. G.). **Memorandum on Measures for the Control of Mosquito Nuisances in Great Britain.**—*Med. Mem. Minist. Hlth* no. 238, 29 pp., 2 pls., 2 refs. London, H.M.S.O., 1940. Price 6*d*.

A brief outline of the importance of mosquitos in England is followed by a survey of the 4 species of *Anopheles* and 17 of the other mosquitos recorded from the British Isles. Notes are given on the habits of each, its distribution and importance in relation to man, and the method of controlling it. The remaining 8 mosquitos are so rare or so seldom bite man that they are considered unimportant as causes of public health problems.

Methods of mosquito control in Great Britain comprise the use of sprays and repellents against the adults, measures that prevent the production of breeding places, destroy them or render them unsuitable for the larvae, the encouragement of natural enemies, and the use of oil and chemical larvicides. The most suitable methods for use against each species, and the season at which the measures should be carried out are summarised. A brief general life-history of mosquitos and directions for collecting and transporting them are appended.

KRISHNAN (K. V.). **Report of the Professor of Malariology and Rural Hygiene.**—*Rep. All-India Inst. Hyg. publ. Hlth 1939* pp. 32–36. Calcutta, 1940.

Data collected during a period of three years concerning the carrier of malaria in the villages round the field centre at Abujhati, Bengal [*cf. R.A.E.*, B **28** 153] were analysed in 1939, and it was found that there were 12 species of *Anopheles* in the area, *viz.*, *annularis*, Wulp, *pallidus*, Theo., *philippinensis*, Ludl., *ramsayi*, Covell, *varuna*, Iyen., *aconitus*, Dön., *hyrcanus* var. *nigerrimus*, Giles, *barbirostris*, Wulp, *vagus*, Dön., *subpictus*, Grassi, *tessellatus*, Theo., and *culicifacies*, Giles. Only *A. philippinensis* was found infected in nature. Of more than 5,148 Anophelines dissected, 1,053 belonged to this species, and 89 had gland infection. *A. philippinensis* was shown to be chiefly a domestic species. In 1936, it was found in 14 out of 845 cow-sheds and 36 out of 160 dwelling houses. The percentage of houses in which it was present varied from month to month, and also from year to year. During the years 1937–39, it ranged from 34 to 90. The use of sprays to destroy *A. philippinensis* in dwelling houses might prove of value. It bred chiefly in reservoirs, but also in borrowpits and canals. On no occasion were the larvae found in any of 12 rice-fields kept under constant observation between 1936 and 1939, and it is thought that the large amount of organic matter in rice-field soil may inhibit breeding by this Anopheline. Seven other species were observed in the fields. *A. philippinensis* was found to breed in association with a variety of aquatic plants including *Pistia stratiotes* and algae, but it

was shown that the removal of *Pistia* would not be a practical proposition as a measure of control ; this plant did not occur in 171 out of 629 breeding places examined during 1936–39.

EDWARDS (F. W.). **A new plain-winged *Anopheles* from Rhodesia.**—*Ann. trop. Med. Parasit.* **34** no. 2 pp. 93–96, 1 fig., 2 refs. Liverpool, 1940.

The adults of both sexes, pupa and larva of *Anopheles* (*Myzomyia*) *ruarinus*, sp. n., are described from Southern Rhodesia, and characters are given distinguishing them from those of *A. rupicolus*, Lewis [*R.A.E.*, B **26** 22]. A comparison of the larvae of the two species is facilitated by the illustrations given by Salem, who redescribed *A. rupicolus* as a new species, *A. aegypti* [**27** 120]. The immature stages of *A. ruarinus* were taken in rock pools containing a small amount of muddy sediment at the bottom, but few weeds, and the adults were bred in captivity. All the material was collected near Salisbury in January and March 1940.

HARDING (R. D.). **The Effect of a Diet of Human Blood on *Trypanosoma brucei* developing in *Glossina tachinoides*.**—*Ann. trop. Med. Parasit.* **34** no. 2 pp. 97–99, 7 refs. Liverpool, 1940.

According to Duke's theory, the Mwanza epidemic of sleeping sickness was caused by *Trypanosoma brucei*, which became established in man because a decrease in game caused *Glossina swynnertoni*, Aust., to feed on man and the resistance of the population was weakened by famine and ankylostomiasis [*R.A.E.*, B **11** 63]. If, however, it is true that *T. brucei* became adapted to man, the essential factor may have been that developing forms of the trypanosome became acclimatised in the fly's gut to human blood repeatedly imbibed by the fly. Some flies, after only one or two meals on game, may have fed on man alone for the remainder of the period necessary for cyclical development of the trypanosome, which may thus have developed a resistance to normal human serum. The failure of the many attempts that have been made to infect man with *T. brucei* may be due to the fact that no attempt has first been made to develop a resistance in the trypanosomes to normal human serum. Against this hypothesis, it is pointed out that Duke provides no real evidence that the Mwanza epidemic was derived from game ; the rate of destruction of the trypanocidal substance of human blood in the fly's gut is unknown ; the peritrophic membrane prevents actual contact between the blood in the gut and the trypanosomes in the peritrophic space, though by analogy with haemoglobin, to which Wigglesworth [**18** 16] has shown the membrane to be freely permeable, the trypanocidal substance, which is associated with the globulin fraction of the serum, might also be expected to pass freely ; the resistance of man to infection by *T. brucei* may be entirely unconnected with the trypanocidal power of his serum ; and, finally, feeding tsetse [*G. palpalis*, R.-D.] infected with a strain of *T. rhodesiense* that had lost the power of infecting man on human blood for the first three weeks of cyclical development did not enable the flies eventually to transmit the infection to man [**23** 135]. The hypothesis thus seems unlikely, but in view of the importance of the question, it appeared worth while to make an experiment.

Pupae of *G. tachinoides*, Westw., were collected and reared, and a strain of *T. brucei* recently isolated from naturally infected horse was obtained in guineapigs. It had a fairly high virulence for guineapigs and disappeared in pure human serum in about 6 hours. Batches of newly emerged flies were given one or two feeds on infected guineapigs and then daily feeds on healthy volunteers. It was intended to continue these feeds until the ability to infect man had been tested, but this became impossible as circumstances prevented the adequate supervision of the health of the volunteers, and a modified experiment was substituted in which a comparison was made of the resistance of the original strain and the one that had passed through the flies to human serum in guineapigs. After being fed for 6 days on a healthy volunteer, the flies were fed for 7 days on citrated human blood and then, when cyclical development was judged to be nearing completion, for a further 7 days on a healthy guineapig. Trypanosomes were first seen in the blood of the guineapig about a week after the last feed and were swarming 14 days later. On this day, serum from the author's blood was injected into the guineapig and into another carrying the parent strain. They were examined on the first, fourth and eighth day following the administration of the serum. No trypanosomes were seen on any occasion in either animal. A crude *in vitro* test appeared to show that the strain that had passed through the flies was even less resistant than the parent strain.

HAWKING (F.). **Distribution of Filariasis in Tanganyika Territory, East Africa.**—*Ann. trop. Med. Parasit.* **34** no. 2 pp. 107–119, 1 map, 23 refs. Liverpool, 1940.

An account is given of the distribution of filariasis in Tanganyika Territory and adjacent areas, based on the author's observations and records in the literature. *Filaria* (*Wuchereria*) *bancrofti* is endemic in the coastal region (microfilarial rate about 30 per cent.), south of Lake Victoria (23 per cent. at Mwanza) as far as Kigoma and Tabora (about 8 per cent.), at the head of Lake Nyasa, and probably also around Mahenge and Liwale in southern Tanganyika and the Teso region, etc., in Uganda. Its distribution seems to be independent of altitude and rainfall, but can be correlated to some extent with temperature. *F.* (*Acanthocheilonema*) *perstans* is endemic north and west of Lake Victoria (microfilarial rate 40–48 per cent.) and around Liwale (30–40 per cent.). Occasional infestations also occur along the coastal region. The main physiological conditions due to filariasis in East Africa are summarised, and it is stated that the suffering, disablement and economic loss caused by them in certain areas are probably considerable. *F. bancrofti* is transmitted by *Culex fatigans*, Wied., which is common in Dar-es-Salaam during the rainy season. In January 1938, just after the shorter rainy season, 362 females of this mosquito were collected from various parts of the town. Of these, 81 were positive for filarial larvae, 49 containing early forms, 48 " thoracic " forms and 2 mature larvae. Of 75 females collected from the neighbourhood where the infection rate seemed highest, 16 were alive at the end of 11 days and 4 of these contained mature larvae. In 1929 [*sic*], 1,265 *Culex* from the houses were dissected and 9 were found to be infected in the proboscis. Of 26 *C. fatigans* fed on a patient and dissected 11–19 days later, 7 were infected in the proboscis and 10 in the thorax only, while 9 were

negative. From a study of the literature, it is concluded that transmission also probably occurs through *Anopheles gambiae*, Giles, and *A. funestus*, Giles.

Hu (S. M. K.). **Studies on the Susceptibility of Shanghai Mosquitoes to experimental Infection with** *Microfilaria malayi* **Brug. I.** *Culex pipiens* **var.** *pallens* **Coquillet.**—*Peking nat. Hist. Bull.* **15** pt. 1 pp. 87–91, 4 refs. Peiping, 1940.

Two batches of *Culex pipiens* var. *pallens*, Coq., reared from larvae collected locally, were allowed to feed for an hour in Shanghai on the nights of 12th and 15th June 1939, respectively, on a filarial subject infected with *Filaria* (*Microfilaria*) *malayi*. The mosquitos that were found to have engorged, of which there were 174 in the first batch and 35 in the second, were kept in screened glass chimneys, fed on soaked raisins, and dissected when enough time had elapsed for any filarial larvae that they were harbouring to develop to the infective stage, except for a few that did not survive so long. One individual of the second batch, dissected 6 days after the infective meal, was found to be harbouring a second-stage filarial larva. The remaining 34 were negative. Of the first batch, 169 were negative, one was harbouring two infective larvae and the other four had one each. The small number infected and the small number of parasites in them indicate that *C. p. pallens* is not very susceptible to infection with *F. malayi*. As regards its practical importance as a vector of *F. malayi* in central China, its low susceptibility might be counterbalanced by its abundance, as it is one of the dominant domestic mosquitos in the region. It breeds in polluted water, of which there is an abundance, and does so from March to December. It constituted 52 per cent. of the 11,740 mosquitos collected during 1934 in a man-baited trap in a village in central China.

[Kekhcher (O. M.).] **Кехчер (О. М.). Essais d'une liquidation d'un foyer paludien dans les exploitations de tourbe de Ozéretzkoie.** [*In Russian.*]—*Med. Parasit.* **9** no. 1–2 pp. 12–38, 5 graphs. Moscow, 1940. (With a Summary in French.)

An intensive anti-malaria campaign was carried out in 1935 and 1936 in a peat-bog district in the Province of Moscow, where *Anopheles maculipennis*, Mg., was abundant, its breeding places, in order of decreasing importance, being temporary accumulations of water densely covered with vegetation and well exposed to the sun, lakes formed by disused turf-pits with an abundant growth of *Elodea canadensis* and low sloping banks overgrown with sedge, recently cut turf-pits only sparsely covered with vegetation, and ditches. The incidence of malaria was also favoured by the scarcity of cattle (24 cows among a population of 1,500) and the bad condition of the workmen's huts, which were damp, dark and badly ventilated and had cracks in the walls, so that the mosquitos readily penetrated to the interior and sheltered there during the day. Data given on the seasonal occurrence of *A. maculipennis* during the two years and the fact that malaria parasites were found in the peripheral blood most frequently in June indicate that the mosquitos of the first generation, which emerge in June, are epidemiologically the most important. From consideration of the effect of the local summer temperatures on the developmental

cycle of the parasites in the mosquito and of the incubation period in man, it is concluded that fresh cases of malaria cannot occur before mid-July and can serve as sources of infection for the mosquito only in August, when most of the females have a developed fat-body and are inactive. It follows, therefore, that the chief sources of infection for the mosquito are latent cases and relapses. The author suggests that the parasite responsible is a strain of *Plasmodium vivax* that has a prolonged period of incubation and is most active in man in spring. Instances of infection with *P. falciparum* also occur, however, and malaria is endemic owing to the constant influx of workmen, many of whom are infected, from other parts of the Russian Union.

Considerable protection was afforded by intensive screening of the workmen's huts and the use of mosquito nets [*cf. R.A.E.*, B **26** 48]. During 1935, relatively few mosquitos were taken in screened huts, and the majority had not fed, evidently because they had no access to the people under the nets. It appears that the mosquitos find suitable shelter and food in nature, as of several thousand that were stained and released in the peat-bog in 1936, only 10–15 were found in the huts on each of the 3 following days ; it seems, therefore, that attacks on the workmen in the turf-pits are unavoidable. Systematic daily catches of mosquitos in houses, cow-sheds and latrines caused a marked decrease in the percentage of older females, and dusting the breeding places from an aeroplane considerably reduced the mosquito population in the second half of the season. It was supplemented by spraying from the ground with a waste machine oil, which proved an effective larvicide, though the larvae remained alive under the film for 14–16 hours, or by dusting with a mixture of 1 part Paris green and 20 parts sifted peat.

From these investigations, the author concludes that the control of mosquitos alone is insufficient to eliminate malaria in the locality. An intensive campaign against the disease in man is essential, and medical treatment of the entire population should be carried out in spring.

[Ivanova (L. V.).] **Иванова (Л. В.). The Influence of Temperature on the Behaviour of** *Anopheles maculipennis* **Larvae.** [*In Russian.*]—*Med. Parasit.* **9** no. 1–2 pp. 58–70, 7 graphs, 2 refs. Moscow, 1940. (With a Summary in English.)

A detailed account is given of laboratory observations in Moscow on the effect of temperature on the movement of fourth-instar larvae of *Anopheles maculipennis*, Mg., races *messeae*, Flni., and *atroparvus*, van Thiel, including experiments in which batches of larvae that had been kept at 19–20°C. [66·2–68°F.] were transferred to water of which the temperature ranged from 3 to 47°C. [37·4–116·6°F.], and were observed for 5–10 minutes at a time, notes being taken of the number of spontaneous movements performed in a minute.

The following is largely based on the author's summary : Larvae on the surface of the water were motionless at temperatures below 5°C. [41°F.], did not feed or respond to stimulation and survived in this state of torpor for several days. Activity began at 6–7°C. [42·8–44·6°F.] and rapidly increased with temperature until it reached a first peak at 17°C. [62·6°F.]. With a further rise in temperature, the number and rapidity of movements gradually decreased, the minimum reaction to temperature being observed at the optimum of 23–28°C.

[73·4-82·4°F.], at which the larvae actively responded to mechanical irritation, but soon became inactive again. This immobility enabled the larvae to feed with maximum intensity [*cf. R.A.E.*, B **25** 140]. A second increase in activity began at 30–32°C. [86–89·6°F.] and reached a peak at 37–39°C. [98·6–102·2°F.]. At 42°C. [107·6°F.], the larvae ceased to move or feed and rapidly died.

When placed in a container about 4 ft. long, in which the temperature of the water was initially 19°C. but was then varied to range from about 37–40°C. [104°F.] at one end to 15–18°C. at the other, most of the larvae congregated where the water had a temperature that approached the optimum and had no irritating effect on them. The larvae in cooler or warmer water were stimulated by temperature and moved about in jerks until they accidentally entered the optimum zone, when thermokinesis ceased and they became almost inactive.

Observations on the reactions of larvae that have dived were carried out in test tubes in which larvae were submerged at different depths. The larvae were able to rise to the surface from a depth of 4 ins. only at temperatures of 7–36°C. [96·8°F.]. The relative smallness of this range in comparison with that for the movements of larvae on the surface of the water is probably due to a greater expenditure of muscular energy in rising. Submerged larvae were most active and their movements very rapid between 19 and 33°C. [91·4°F.]. At 37–38°C. [100·4°F.] they still attempted to rise, but soon dropped to the bottom. The inhibiting effect of high temperatures persisted for some time after the larvae had been transferred to more favourable conditions, but larvae kept for a time in water at 3–5°C. readily rose to the surface as soon as the water was heated to a temperature at which rising was normally easy. A submerged larva reacted to light [*cf.* **25** 140] only within the temperature range of 7–36°C.

[Starostin (S. T.).] **Старостин (С. Т.). Propriétés physico-mécaniques des ingrédients et leur influence sur le travail de l'avia-pulvérisateur et la qualité de la verdification par avion des collections d'eau anophélogènes.** [*In Russian.*]—*Med. Parasit.* **9** no. 1–2 pp. 71–77, 12 refs. Moscow, 1940.

In the course of dusting with Paris green from an aeroplane against Anopheline larvae in the Province of Alma-Ata (Kazakstan) in 1937, it was found that the effectiveness of the treatment largely depended on the carrier with which the larvicide was mixed. Road-dust is the ingredient commonly used in Alma-Ata, and samples of dusts taken in various localities were therefore analysed. The results, which are tabulated, showed that road-dust from different regions possessed widely differing physical and chemical properties. The dusts that flowed best were those that showed little or no reduction in volume when submitted to pressure in a container ; dusts that became more compact formed lumps and flowed with difficulty, or, in extreme cases, did not flow at all, whether used alone or mixed with Paris green. In order to prevent the dust from becoming compacted, the aeroplane should be flown as evenly as possible, and jolting when taking off should be reduced to a minimum. The easy flow of the dust was also impaired if it was damp, the least hygroscopic kind proving the best carrier ; dust that was exposed throughout the night to the open air became damp and clogged. Road-dust that consisted chiefly of sand and contained only a minimum number of particles of clay (smaller

than 0·005 sq. mm. in size) had the most rapid and easy flow, but much depended also on the type of sand. Thus, river or desert sand was the most suitable, as its particles are polished and almost oval in shape, whereas that from mountains or foothills is angular and more apt to form a compact mass. Road-dusts with the smallest angle of slope had the best flow; those with an angle of slope greater than 38° were unsatisfactory.

[Lazuk (A. D.).] **Лазук (А. Д.). Données comparatives sur l'efficacité de diverses méthodes de délarvation des bassins.** [*In Russian.*]—*Med. Parasit.* **9** no. 1–2 pp. 78–84, 3 graphs. Moscow, 1940. (With a Summary in French.)

Experience in the control of Anopheline larvae in the region of Smolensk (western Russia) suggests that dusting from an aeroplane is impracticable in low-lying densely populated areas near large rivers, as the breeding places are small, scattered and interspersed with pastures and meadows. On the other hand, it is the most effective method of treating large turf-pits in peat-bogs, which are usually inaccessible for hand-dusting. Estimates are given showing that the cost of treating such areas with Paris green from an aeroplane is half that of dusting with Paris green from the ground and one-fifth that of spraying with crude oil. The local effectiveness of the method was demonstrated in 1938 by a steady decrease in the numbers of mosquitos from May to September in cow-sheds and workmen's huts. The aeroplane dusting was supplemented by the destruction of mosquitos in their day-time shelters, the best results being obtained by spraying with an emulsion of 1 gal. kerosene and about 7 lb. soft soap in 30 gals. water.

[Simachkova (M. S.).] **Симачкова (М. С.). Sur la phénologie de l'*A. maculipennis messeae* au vil. Kazan-Chunkur, région orientale du Kazakhstan.** [*In Russian.*]—*Med. Parasit.* **9** no. 1–2 pp. 85–92. Moscow, 1940.

A detailed account is given of investigations carried out in 1936 in the valley of the river Irtuish, east of Semipalatinsk, where *Anopheles maculipennis*, Mg., was found to be the only vector of malaria and all the egg-batches obtained belonged to race *messeae*, Flni. The climate is continental, rainfall is most abundant in May and June and conditions favourable to the development of the mosquito may occur from mid-April to the end of September. Its breeding places included swamps, pools formed in various ways and deep pits, but the larvae were most abundant in flooded areas, particularly near the day-time shelters of the adults (dwellings and animal quarters). The overwintered females became active in the second half of May, and larvae were observed in the first half of June; adults of the first generation (which were the most numerous) emerged about mid-July and those of the second about mid-August. By the second half of August, 39·7 per cent. of the females had a developed fat-body. Hibernation began at this time and occurred in cellars and storehouses, and particularly in deep water-reservoirs, including some in the mountains 2½ miles from a village. Of 63 females dissected in July, five contained oöcysts.

[Mironov (V. S.).] **Миронов (В. С.). Habitats of the Taïga Tick *Ixodes persulcatus* P. Sch. in Kama Region.** [*In Russian.*]—*Med. Parasit.* **9** no. 1–2 pp. 93–105, 2 figs., 1 graph, 20 refs. Moscow, 1940. (With a Summary in English.)

In view of the part played by *Ixodes persulcatus*, Schulze, in the transmission of the virus of taïga encephalitis [*cf. R.A.E.*, B **27** 70, 239, 240], investigations on its ecology were carried out in the summers of 1938 and 1939 in the Province of Ussuri (Russian Far East) and the basin of the middle Kama (Province of Perm), in both of which epidemics of the disease occur. The microclimatic conditions required for the development of the tick are discussed. In laboratory experiments at 18–28°C. [64·4–82·4°F.] and a relative humidity of 60–80 per cent., engorged females died in a week and starved ones in 1–2 days. It appears that constant and high humidity is essential for the survival of this tick. In the Province of Ussuri such conditions are found in coniferous and mixed forests, which consequently are its usual habitat. It was especially abundant in the primeval forest (taïga) in the mountainous country, whereas *Haemaphysalis concinna*, Koch, predominated in deciduous and mixed forests on the slopes of valleys and *Dermacentor silvarum*, Olen., in the open hilly plain [*cf.* **27** 70]. In the valley of the river Kama, *I. persulcatus* was absent from dry forests and abundant in mixed forests of deciduous trees and conifers in which the water table was close to the surface of the soil. It was also abundant on flat gently sloping watersheds in forests consisting chiefly of spruce and limes with a dense undergrowth of grasses and shrubs. It gradually disappeared from areas that were exposed to the sun and became dry as a result of felling and clearing. In the Kama region, nymphs and adults of *I. persulcatus* were taken on cows, goats, and dogs that frequented forests, and larvae and nymphs on various small mammals and birds, details of the infestation of which are given.

[Mironov (V. S.), Nabokov (V. A.) & Kachalova (E. K.).] **Миронов (В. С.), Набоков (В. А.) и Качалова (Е. К.). Le derris et ses propriétés insecticides.** [*In Russian.*]—*Med. Parasit.* **9** no. 1–2 pp. 106–108. Moscow, 1940.

An account is given of laboratory experiments in Moscow on the value of imported derris root (*Derris elliptica*) for the control of various Arthropods. Adults of *Musca domestica*, L., *Culex pipiens*, L., and *Aëdes cinereus*, Mg., placed in glass containers were dusted with the powdered root at from 0·1 to 2 gm. per cu. m. or with pyrethrum powder at 1 or 2 gm. The derris killed all flies and mosquitos in 24 hours when applied at rates of 0·25 and 1 gm., respectively, whereas the pyrethrum, at either rate of application, did not give 100 per cent. mortality in this period. In the case of *Musca*, 10 per cent. anabasine sulphate (anabadust) [*cf. R.A.E.*, B **26** 170] at 2 and 4 gm. was also tested, but the higher rate gave only 47·9 per cent. mortality. The paralysing action of pyrethrum was much more rapid than that of derris; when applied at the rate of 1 gm. per cu. m., it brought down all the adults of *C. pipiens* in 15 minutes, whereas derris at the same rate brought down only 48 and 86 per cent. of *Culex* and *Aëdes* in 3 hours.

In tests against ticks, nymphs of *Ornithodorus moubata*, Murr., and *O. tartakovskyi*, Olen., were not affected by derris powder, but larvae

and nymphs of *Ixodes ricinus*, L., were killed by it in ½–1 and 1–2 hours, respectively; the adults were more resistant. Good results were given by a water extract of 1½ gm. derris powder in 300 cc. of 2 per cent. soap solution, and larvae of *I. ricinus* died in 10–20 minutes after crawling on dry filter paper that had been soaked in it.

On the basis of these observations the authors conclude that derris may be of great value in the control of Arthropods that transmit disease in the Russian Union, and since other workers have shown that derris and related plants can become acclimatised there, they should be cultivated on a large scale in the subtropical districts.

[Pogodina (E. A.) & Sokolov (A. G.).] **Погодина (Е. А.) и Соколов (А. Г.). Nuages d'alkaloides dans la lutte contre les moustiques.** [*In Russian.*]—*Med. Parasit.* **9** no. 1–2 pp. 109–111. Moscow, 1940.

Investigations were carried out in 1939 in Moscow on the possibility of destroying Anophelines in buildings by the light mist or aerosol [*cf. R.A.E.*, B **28** 239] resulting from the evaporation of anabasine by heat. One method of obtaining it was to pour a water solution of anabasine sulphate on to quick-lime; this produces a temperature approaching the boiling point of basic anabasine (280·9°C.) and liberates the latter, which evaporates and condenses in the air to form an aerosol. The correct proportion was found to be 1 part anabasine sulphate and 1 part water to 6 parts lime; the anabasine sulphate contained 25 per cent. anabasine, 15 per cent. of other slightly toxic alkaloids and 40 per cent. water. The minimum concentration of anabasine in air that killed all Anophelines in the room in 8 minutes was 0·2 oz. per 1,000 cu. ft., and the rate at which anabasine sulphate must be used to give this is 1 oz. per 1,000 cu. ft. This rate is considerably smaller than that required for fumigating with hydrocyanic acid gas. On hot days in summer, the mosquitos abandoned their resting places in about 2 minutes after the aerosol was produced and tried to make their way to a source of fresh air, but then dropped to the floor. Most of them died without moving again, and though a few lived for a day or two and even sucked blood, they did not oviposit. The aerosol has an unpleasant smell and causes coughing; the mouth and nose of the operator should therefore be protected with a mask of muslin and moist cotton-wool. In the summer, the aerosol rapidly dispersed, the odour disappeared in 15–20 minutes, and mosquitos released then in a treated room were not affected. At temperatures of 0°C. [32°F.] or below, the dosage of anabasine sulphate had to be increased to 1½ oz. per 1,000 cu. ft. The aerosol produced under these conditions was more stable and killed mosquitos that were introduced into the room an hour after the end of the chemical reaction.

An aerosol was also produced by dropping basic anabasine or anabasine sulphate (used at rates of 1½–2 and 5–6 oz. per 1,000 cu. ft. of room space, respectively) on sand that had been heated in a pan on a stove to a temperature of 300–350°C. [572–662°F.], which caused the anabasine to evaporate immediately. The aerosol was harmless to rabbits and fowls and did not affect food-stuffs or the germination of seeds. Preliminary investigations showed that mosquitos could also be controlled by an aerosol produced from nicotine or nicotine sulphate by either of the above methods.

[Nabokov (V. A.) & Zeĭfert (Yu. A.).] **Набоков (В. А.) и Зейферт (Ю. А.). Pulvérisateur pneumatique du système de W. Nabokov et J. Zeïfert (NZ) approprié au transport par fardeaux.** [*In Russian.*] —*Med. Parasit.* **9** no. 1–2 pp. 112–115, 2 figs. Moscow, 1940.

A detailed description is given of a spraying apparatus of which the reservoir consists of two metal cylinders mounted on a horse. It is designed to apply liquid larvicides to Anopheline breeding places. The technique of using it is discussed.

[Nabokov (V. A.), Zeĭfert (Yu. A.) & Kachalova (E. K.).] **Набоков (В. А.), Зейферт (Ю. А.) и Качалова (Е. К.). Une attrapoire hygiénique pour les moustiques (NZ) du système de W. Nabokov et J. Zeifert (témoignage de brevet No. 1911/19107).** [*In Russian.*] —*Med. Parasit.* **9** no. 1–2 pp. 116–118, 1 fig. Moscow, 1940.

In order to obviate the fatigue usually resulting from work with the ordinary type of aspirator trap used for catching mosquitos, in which the air is drawn up by mouth, the authors have devised a modified trap, which is easy to operate and more hygienic. Air squeezed from a rubber bulb is blown through a nozzle inside a tube through which it passes into a muslin bag. The narrow end of the funnel that is placed over the mosquito opens into the tube just below the nozzle. The mosquito is thus sucked up the funnel and blown into the bag.

[Biryukov (V. I.) & Lavrenko (E. M.).] **Бирюков (В. И.) и Лавренко (Е. М.). Matériaux concernant la distribution de l'*Anopheles maculipennis atroparvus* dans la ville Zmiev de la région de Kharkov.** [*In Russian.*]—*Med. Parasit.* **9** no. 1–2 pp. 146–147. Moscow, 1940.

In the course of investigations in July–September 1938 in the environs of Zmiev (Province of Kharkov), females of *Anopheles maculipennis*, Mg., collected in cow sheds were induced to oviposit, and the races present were determined by the pattern on the upper surface of the eggs. The results showed that most of the females belonged to race *messeae*, Flni., the next in abundance being race *atroparvus*, van Thiel, which has not previously been recorded from this district. Females of this race were not taken in July and were more numerous in August than in September; they occurred chiefly in sheds in the higher part of the town about 550 yards from the river. Race *maculipennis* (*typicus*) was the least numerous and was not taken in September.

[Gendel'man (Tz. A.) & Markova (O. V.).] **Гендельман (Ц. А.) и Маркова (О. В.). Répartition de la malaria tropicale dans les rayons septentrionaux de la région de Dniepropetrovsk.** [*In Russian.*]—*Med. Parasit.* **9** no. 1–2 pp. 147–149. Moscow, 1940.

A survey in August and September 1937 in two of the most northerly districts of the Province of Dniepropetrovsk, in the central Ukraine, revealed the presence of large numbers of *Anopheles maculipennis*, Mg., the main breeding places of which were swamps, lakes and a shallow slow-flowing river. The development of the mosquitos was favoured

by suitable summer temperatures, and the adults were abundant in dwellings and particularly in animal quarters situated close to the water. The eggs collected belonged, in order of descending abundance, to races *atroparvus*, van Thiel, *messeae*, Flni., *melanoon*, Hackett, and *maculipennis* (*typicus*). Of 723 females dissected, 6 had oöcysts on the stomach. A considerable reduction in the incidence of malaria had occurred between 1935 and 1937 as a result of medical treatment of the population, a general improvement in living conditions and the screening of windows. The parasite index was 5·04 per cent., 4·74 per cent. of the persons examined harbouring *Plasmodium vivax* and 0·28 per cent. *P. falciparum*. Malaria was most intense in the spring and autumn.

Roy (D. N.) & Ganguly (S. K.). **Linguatulid Infection in Man.**—*Indian med. Gaz.* **75** no. 8 p. 478, 1 fig., 3 refs. Calcutta, 1940.

Five living nymphs of *Linguatula serrata*, Fröl., were expelled by coughing and sneezing from the respiratory tract of a patient in Bengal, whose chief complaint was of pain in the frontal sinuses for some time. This is thought to be the first record of Linguatulid infection in man in the East. There was a history of close association with dogs, and it is probable that infection was acquired from them. A note is given on the appearance and systematic position of Linguatulids, together with a short review of the life-history of *L. serrata* from the literature, in which it is considered that nymphs are sniffed up by dogs, and that the fully developed nymph may leave the cyst and migrate to the bronchi or to the intestine of the intermediate host [*cf. R.A.E.*, B **28** 193]. Previous records of infestation in man are also given.

Sanders (D. A.). *Hippelates* **Flies as Vectors of Bovine Mastitis (Preliminary Report).**—*J. Amer. vet. med. Ass.* **97** no. 763 pp. 306–308, 1 fig., 5 refs. Chicago, Ill., 1940.

In view of the results of previous work [*R.A.E.*, B **28** 203], investigations were carried out in Florida on the possibility of transmission of bovine mastitis by flies of the genus *Hippelates*. Preliminary observations had shown that these flies frequent the mucous membranes of cattle and abound beneath the abdomen near the udders, and that they feed on lachrymal fluid, sebaceous material, wound excretions, spilled drops of milk and mucopurulent secretions on the vulvular hair tuft and at the tip of the teats of cows known to be carriers of organisms causing mastitis. They were also observed feeding around the udders and at the tips of teats of calves, yearlings and pregnant heifers in herds where mastitis was present. Stained smear preparations of *Hippelates* that had hovered around the udders of infected cows showed the presence of organisms resembling those observed in cases of bovine mastitis. In preliminary tests, milk incubated with *Hippelates* and filtered to remove the insects produced purulent, bloody, ascending mastitis when injected into the milk cistern of healthy quarters by way of the teat, and other cases were produced by flies brought into contact with the orifice of the teat by means of rubber sacks containing milk. Controlled experiments were carried out in which the teat orifice, moistened by pressing milk through the teat duct, was exposed to *Hippelates* that had been taken beneath the abdomen of cattle infected with mastitis, and in some instances permitted to feed for a few seconds on a swab moistened with

secretion from infected udders, or to others taken directly from infected premises. The flies coming in contact with the moist surface clustered round the sphincter in an effort to engorge. The method of presenting the teat prevented them from engorging immediately and permitted them to feed for long periods, so that their serrated mouth parts produced lesions, the tissues round the orifice becoming chafed with a tendency to scar formation. Mastitis developed in several udder quarters so exposed. Active infection also developed in quarters in which the milk was allowed to remain, as during drying-off before calving. It is also suggested that, in addition to being vectors of bovine mastitis, flies of the genus *Hippelates* may serve as reservoirs of bacteria capable of causing it, since examples from localities far removed from dairy herds show a bacterial flora resembling that of those collected about cattle.

ROBERTS (F. H. S.). **A Survey of the Ectoparasites of Dogs in Brisbane, Queensland.**—*Proc. roy. Soc. Qd* **51** pt. 2 pp. 147–149, 5 refs. Brisbane, 1940.

Since 1935, when a check-list of the Arthropod parasites of domestic animals in Queensland [*R.A.E.*, B **23** 306] recorded 16 species from the dog, 101 dogs in the Brisbane area have been examined. Fleas were present on all the dogs, a total of 3,358 being collected. They comprised *Ctenocephalides felis*, Bch., which was found on 95 dogs and represented 64·9 per cent. of the fleas examined, *C. canis*, Curt., which was taken from 88 dogs, mostly those used for droving, and represented 33·75 per cent., 40 examples of *Pulex irritans*, L., taken on 12 dogs, two of *Pygiopsylla congrua*, J. & R., taken from a house dog that was accustomed to visit river banks where the water rat, *Hydromys chrysogaster*, which is the normal host of this flea, is abundant, and one of *Ceratophyllus* (*Nosopsyllus*) *fasciatus*, Bosc, also found on a house dog. *Xenopsylla cheopis*, Roths., which is common on rats in Brisbane, was not found on any dog, even those used for rat-catching. Lice were taken on eight dogs, *Trichodectes canis*, DeG., on three, *Linognathus setosus*, Olf., on four and the kangaroo louse, *Heterodoxus longitarsus*, Piag., on one. The only tick found was *Rhipicephalus sanguineus*, Latr., which occurred on 15 dogs. The ectoparasites previously recorded from dogs in Queensland [*loc. cit.*] included all the above, except *P. congrua*, and also *Boophilus annulatus microplus*, Can. (*australis*, Fuller), *Ixodes holocyclus*, Neum., *Amblyomma triguttatum*, Koch, *Sarcoptes canis*, Gerl., *Otodectes cynotis*, Her., *Demodex canis*, Leyd., *Trombicula minor*, Berl. (*hirsti*, Sambon) and *T.* (*Leeuwenhoekia*) *australiensis*, Hirst. In addition, *Echidnophaga myrmecobii*, Roths., which was not seen in this survey, has been taken on dogs at three places [*cf.* **27** 249].

SHERRICK (J. L.). **What Standard for Stock Sprays ?**—*Soap* **16** no. 9 pp. 92–97, 111, 6 figs., 7 refs. New York, N.Y., 1940.

At present, the terms "cattle spray" and "stock spray" are applied in the United States to many products that are merely cheaply made household insecticides, and are unsuitable for use on the body of an animal, as they are made up with light oil with a viscosity of 30–35 seconds Saybolt at 100°F., which is apt to scorch and injure the hide. It is, therefore, considered desirable to establish a standardised procedure for testing and grading sprays designed to

protect farm animals from flies, as has already been done for household sprays. Although good knock-down and kill are important attributes of a cattle spray, repellency is even more important. The base oil and other ingredients should not stain the animal's coat or injure the animal when the spray is applied in dosages adequate for insect control. A study of cattle sprays is reported in this paper, and it is thought that the results and the test methods used may contribute to a better understanding of the factors involved and to a possible standardisation of test methods. As it is known that the viscocity and body of the oil have an influence on the power of certain toxic ingredients, the formulae were made up in each of three representative types of oil.

The object of the paper being to present test methods and general results rather than evidence for or against particular materials, the formulae are given in code letters. The knock-down and kill of the various substances in three grades of oil were tested on flies [*Musca domestica*, L.] by the Peet-Grady method [*R.A.E.*, B **26** 244], the kill being adjusted to a 60 per cent. kill for the Official Test Insecticide. Their repellency was first tested in alcohol by Kilgore's method [**27** 250], and later by a modification of it, in which the various formulae were compared with each other instead of with citronellol, but as it was felt that the nature of the oil used might influence repellency as it had been found to influence knock-down and kill, and it seemed desirable to modify the test in such a way as to make possible the direct comparison of competitive sprays, the exact composition of which was not known, further modifications were tried, by one of which sprays made up with medium and heavy oil were compared. The order of repellency obtained with alcohol solutions was quite different from that obtained with the oil sprays. In general, the order in the two series of oil sprays was similar. The results indicated the possibility of using such tests to compare the repellency of sprays, and the preliminary work being completed, a formula made up in oil with a viscosity of 47 secs. Saybolt at 100°F. was chosen as a standard of comparison for future work. A heavy oil (viscosity 73 secs.) is not considered suitable, as it blankets the hide for too long a time. It is considered that the desirability of having some official test cattle spray has been demonstrated, and it is suggested that the same one might be used for the Peet-Grady tests and the repellency tests.

BOYNTON (W. H.) & WOODS (G. M.). **Anaplasmosis among Deer in the Natural State.**—*Science* **91** no. 2355 p. 168, 3 refs. New York, N.Y., 1940.

Investigations on a ranch in California in 1939 showed that carriers of anaplasmosis occurred among deer [*cf. R.A.E.*, B **22** 37]. Blood showing *Anaplasma* from deer infested with *Dermacentor occidentalis*, Marx, was injected into a young cow and produced typical symptoms of anaplasmosis. The ticks were probably the sole means of contact between the cattle on the ranch and the deer in the natural state in that area.

HERTIG (M.). **Glass Tubes for rearing *Phlebotomus* and other Insects.**—*Science* **92** no. 2378 pp. 91–92, 1 fig., 1 ref. New York, N.Y., 1940.

A new type of vessel devised for breeding *Phlebotomus* spp. consists of a piece of glass tubing 8–9 mm. in diameter and 8 cm. long, having

one end filled to a depth of 10–12 mm. with plaster of Paris and the other closed with cotton-wool. Larger tubing would be required for large sandflies, such as *P. peruensis*, Shannon. The tubes may be made in quantities by standing bundles of cut tubing in dishes of freshly mixed plaster. Before they are used, the plaster is moistened by contact with wet cotton. When containing sandflies, they may be stored, plaster end down, in moist earthenware pots, or in pans with a thick bottom layer of plaster. The highest degree of moisture short of condensation on the glass walls is desirable. The eggs are laid on the plaster or on the glass just above. The original tube may be kept as a breeding tube for the larvae, but as there is usually not room enough for the offspring of one female, it is better to transfer the eggs to a standard earthenware breeding-pot. Adult sandflies live as long in the plaster tubes as in the breeding-pots, and the average yield of eggs is probably greater. Tubes of this type have also been used successfully in breeding several species of fleas, and they are of use in the transport and temporary storage of various living insects.

Riley (W. A.). **The Tropical Rat Mite, *Liponyssus bacoti*, in Minnesota.**—*J. Parasit.* **26** no. 5 p. 433. Lancaster, Pa., 1940.

The increasing number of records of the rat mite, *Liponyssus bacoti*, Hirst, in the United States indicates that, like *Xenopsylla cheopis*, Roths., it spreads with its host, and may be found established far beyond its supposed range. Some ten years ago, mites of this species were found in the offices of a milling company in Minneapolis after a fumigation in which numerous mice, and probably rats also, were killed; they soon disappeared. Three years ago, an infestation was found at St. Paul in a rat-infested house near a dump that harboured many rats. Mites reported in late January 1940 to be causing "peculiar, itching, macular skin eruptions" on employees in a store at Pipestone in the south-western part of the State, and others that had invaded a house at Blue Earth in which there was a heating plant and rats were numerous, were identified as typical *L. bacoti*. Several other infestations have been reported in which *L. bacoti* is thought to have been the species concerned, although no specimens have been received. *L. sylviarum*, C. & F., is not uncommon in Minnesota and may cause annoyance to handlers of live poultry, but the author has not found cases of severe dermatitis in man caused by it.

Papers noticed by Title Only.

Komp (W. H. W.). **The Occurrence of *Anopheles darlingi* Root in British Honduras and Guatemala.**—*Science* **91** no. 2370 pp. 522–523, 6 refs. New York, N.Y., 1940. [*Cf. R.A.E.*, B **28** 198.]

Lumsden (W. H. R.) & Bertram (D. S.). **Observations on the Biology of *Plasmodium gallinaceum* Brumpt, 1935, in the Domestic Fowl, with special Reference to the Production of Gametocytes and their Development in *Aëdes aegypti* (L.).**—*Ann. trop. Med. Parasit.* **34** no. 2 pp. 135–160, 6 figs., 28 refs. Liverpool, 1940.

Lumsden (W. H. R.) & Bertram (D. S.). **The Effect of Plasmoquine and of Praequine on the subsequent Development of the Gametocytes of *Plasmodium gallinaceum* Brumpt, 1935, in *Aëdes aegypti* (L.).**—*Ann. trop. Med. Parasit.* **34** no. 2 pp. 161–172, 3 figs., 19 refs. Liverpool, 1940.

REHN (J. A. G.). **The Cockroach *Supella supellectilium* in California (Orthoptera: Blattidae).**—*Ent. News* **51** no. 8 p. 222. Philadelphia, Pa., 1940.

The distribution of *Supella supellectilium*, Serv., in the United States, where it has been spreading rapidly during the last few years [*cf. R.A.E.*, B **26** 78 ; **27** 55 ; **28** 61], is briefly reviewed, and it is recorded for the first time from California, where it was found in a residence at San Bernardino on 8th April 1940.

KOBAYASHI (H.). **Passing Winter in Flies.** [*In Japanese.*]—*Rep. Jap. Ass. Adv. Sci.* **15** no. 2 pp. 233–236. Tokyo, 1940.

The results are given of observations on the stages in which various flies occur in Korea in winter. The adults of *Musca domestica*, L., are common, the larvae and pupae do not become dormant, and oviposition and larval development occur at temperatures as low as 15°–16°C. [59–60·8°F.]. Only pupae of *Sarcophaga* spp. and only fertilised females of *Muscina stabulans*, Fall., were observed, but both sexes of *Fannia canicularis*, L., were present, and oviposition took place ; the pupae are also apparently able to overwinter. Prepupae, pupae and adults of *Lucilia sericata*, Mg., sometimes occur, but the adults do not become common until March.

HINDMARSH (W. L.) & BELSCHNER (H. G.). **Blowfly Strike of Sheep. Blue Colouration of the Breech. Trials disprove alleged repellent Properties.**—*Agric. Gaz. N.S.W.* **51** pt. 4 pp. 185–187. Sydney, 1940.

As considerable publicity had been given to a claim made by G. Watt that a blue colour applied to the breech of sheep affords protection from blowfly strike, trials of the method were made in New South Wales and are reported in this paper. The di-boric preparation of boric acid and glycerine [*R.A.E.*, B **23** 292 ; **24** 133 ; **27** 61] was tested at the same time. In the first experiment, begun on 7th November on sheep that had been shorn in early August and dipped on 15th October, 100 ewes were treated with blue colour, 100 were treated with the di-boric preparation used undiluted and 100 left untreated. The blue, which was supplied by Watt and appeared to be blue raddle, was applied after the wool of the breech had been wetted with the di-boric dressing in water (2 oz. to 1 gal.) and was used much more liberally than was directed in his instructions, which were for sheep sheared two weeks previously. Within a week of the treatment, 8 of the control sheep, 6 of the coloured sheep and none of the group treated with the undiluted dressing were struck, and 6 weeks after treatment, the figures were 16, 20 and 8, respectively. The blue colour faded quickly on the surface of the wool, and a month after treatment it was difficult to distinguish. In a further experiment with the same three groups of sheep, a blue solution (49B) prepared by a Sydney chemist and stated to be used by Watt for large flocks, was applied on 21st March to 55 sheep, and Solway ultra blue (1 per cent. solution) to 45, the sheep having been crutched on 6th March. There was very little fly strike in the nine weeks following treatment, but it was evenly distributed among coloured and uncoloured sheep and those that had been treated with the di-boric dressing. The blue faded on the

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surface, and in many cases was imperceptible two months after treatment. The sheep treated with Solway ultra blue retained the colour longer than those sprayed with 49B.

J. H. Riches, who tested the method for the Council for Scientific and Industrial Research in Queensland, reported that treatment with raddle supplied by Watt gave no protection against strike, as there was an incidence of 17·8 per cent. strike among the treated sheep and 12·2 per cent. among the untreated ones.

LEBERT (F.). *Gasterophilus inermis* **Brauer et son rôle pathogène. La dermite estivale des joues du cheval.**—Thesis 93 pp., 5 figs., many refs. Alfort, 1939. (Abstr. in *Vet. Bull.* **10** no. 11 pp. 843–844. Weybridge, 1940.)

This thesis consists mainly of a critical review of the literature on *Gastrophilus* (*Gasterophilus*) *inermis*, Br. It deals, in addition to the pathological aspects, with classification, morphology, biology, treatment and prophylaxis and geographical distribution. Particular attention is paid to the part played by the first-stage larvae in the aetiology of summer dermatitis of the cheek in horses. Observations are described showing that parasitism of the rectum by *G. inermis* usually accompanies summer dermatitis. In four out of five affected animals, larvae were discovered in the rectum. The main conclusions are as follows : the larvae spend a part of the second stage and the whole of the third stage in the rectum ; oviposition is confined to the cheeks ; summer dermatitis of the cheek in horses is caused by *G. inermis* ; the lesions of summer dermatitis in France are not serious ; the parasite causes prolapse of the rectum in North Africa, where infestation is more intense owing to the heat ; and *G. inermis* occurs throughout Central Europe and seems to be spreading in France from east to west.

PATIÑO-CAMARGO (L.). **Artrópodos hematófagos de la fauna colombiana.** [Blood-sucking Arthropods of Colombia.]—*Rev. Acad. colomb. Cienc.* **3** no. 11 pp. 337–344, 23 refs. Bogotá, 1940.

A list is given of 183 blood-sucking Arthropods, of which 131 are mosquitos, collected in Colombia by various workers. The localities in which they were found are recorded, and very brief notes on the relation of some of them to disease are included.

CHUNG (Hui-Lan). **On the Relationship between Canine and Human Kala-azar in Peiping and the Identity of *Leishmania canis* and *Leishmania donovani*.**—*Chin. med. J.* **57** no. 6 pp. 501–523, 4 pls., 1 diagr., 44 refs. Peking, 1940.

The names *Leishmania donovani* and *L. canis* are used for the organisms causing visceral leishmaniasis in man and general leishmaniasis in dogs in China, but the author concludes from the evidence presented in this paper that *L. canis* is identical with *L. donovani*, and that dogs are the source from which it is transmitted to man. This evidence includes the close association of the two forms of kala-azar in Peiping and other places where human kala-azar is endemic ; the failure of the treatment and cure of all human cases in a village to prevent the continuous occurrence of fresh cases, presumably owing to the presence of a canine reservoir ; experiments in which hamsters and a man could not be infected with *L. canis* after having been recently

cured of an infection with *L. donovani*; the impossibility of distinguishing the organisms by serological tests, their structure, their behaviour in laboratory animals or their manner of development in *Phlebotomus chinensis*, Newst. [*cf. R.A.E.*, B **28** 34, etc.]; and the fact, confirming the importance of dogs as a source of the disease, that cutaneous infection is common and heavy in them, whereas it is slight and usually absent in man, so that *P. chinensis* can be infected only with difficulty by feeding on kala-azar patients, but can be easily infected by feeding on infected dogs.

CHANG (T. L.). **The Anopheline Mosquitoes of Yunnan. Notes on their Breeding Habits and Adult Behaviour.**—*Chin. med. J.* **58** no. 2 pp. 218–233, 12 refs. Peiping, 1940.

The results are given of a survey made between April and October 1939 of the Anopheline fauna of Yunnan. The species taken comprise those recorded in a previous paper [*R.A.E.*, B **28** 156] and also *Anopheles jamesi*, Theo., which had not previously been reported from the Province. Brief notes are given on the breeding habits of each species and on the adult behaviour of many of them. In Mangshih, 14 species and varieties of *Anopheles* were found. *A. hyrcanus* var. *sinensis*, Wied., which was the commonest throughout all the districts visited, constituted 28·22 per cent. of the adults and 28·97 per cent. of the larvae taken in the vicinity of Mangshih and more than 90 per cent. of both larval and adult collections on the table-lands. It was found throughout the period of the survey, but was more prevalent during the summer monsoon season. It breeds chiefly in clear water in rice-fields and swamps. Adults were caught in houses as well as in cow-sheds (most of which consist merely of a thatched roof supported on posts) and pigsties, and voraciously sought human blood even when cattle and pigs were numerous. In a study of the relative prevalence of Anophelines in a cow-shed and an adjoining dwelling house, the total numbers taken in house and shed in eight weekly collections were 266 and 51, respectively, and *A. h. sinensis* represented 57·8 per cent. of the total.

It is thought that other species may be of equal or greater importance as vectors of malaria in the low-lying plains such as Mangshih and Chefang. These include *A. minimus*, Theo., *A. annularis*, Wulp, and *A. maculatus*, Theo., of which the percentages of adults taken in the vicinity of Mangshih were 23·27, 28·06 and 6·96, and of larvae, 24·67, 24·80 and 8·20, respectively. In the plains, the numbers of *A. minimus* increase gradually as the monsoon season advances, until it becomes the dominant species. It breeds in slowly running water with a certain amount of shade. The adults, which bite at night, were repeatedly found inside houses. They usually do not return to their hiding places immediately after engorging, but rest on nearby walls, grass blades, etc., for some time, retreating to a better hiding place just before day-break. Day catches were invariably higher in poorly ventilated or badly lighted houses than in others. Limited numbers of adults were also found in cow-sheds. It is thought that they enter them to feed but afterwards go to a darker hiding place. *A. annularis* was found only in the low-lying plains, where it was caught in large numbers in occupied and unoccupied rooms of houses. The female was one of the most avid suckers of human blood. Feeding takes place readily in the evening, but occurs occasionally in the day, especially

when the light is poor. The relative abundance of the species in dwellings and cow-sheds appeared to be similar to that of *A. h. sinensis*, though on one occasion 296 individuals were found resting in an unusually damp, ill-ventilated cow-shed, while the bed-room, which was opposite, yielded only 11. The larvae prefer clear, weed-grown, stagnant waters, though they sometimes occur in flowing water. *A. maculatus* was found in almost every district visited along the China-Burma highway except the plateau of Kunming. It breeds in streams and river-beds, preferably in slowly running water, and also in pools, springs, seepages and lake margins. The adults were taken commonly in houses but not often in cattle-sheds. It was one of the dominant species before and after the monsoon season, but during the season, it formed only a small percentage of the total catches, though its numbers remained practically constant.

The only other species of which the adults constituted more than 4 per cent. of the total taken in the vicinity of Mangshih was *A. jeyporiensis* var. *candidiensis*, Koidz., which formed 6·30 per cent. of the adults and 5·78 of the larvae. The adults were collected from houses as well as cattle sheds but in limited numbers only.

TWEEDIE (D. R.). **Fascine Drainage as an Anti-malaria Measure.**—*J. Malaya Br. Brit. med. Ass.* **4** no. 2 pp. 167–171, 2 pls., 2 figs. Singapore, 1940.

Work by the author in Bengal in 1936 and subsequently in Malaya has confirmed the value of the method of packing drains and tributaries of ravines with tree trunks and branches covered with grass (fascine drainage) to prevent the breeding of Anophelines in them [*cf. R.A.E.*, B **22** 149]. He gives a summary of the technique, an important point of which is the covering of the packed drain with a good layer of soil [*cf.* **22** 150], on which the speedy growth of vegetation should be encouraged as a protection against scouring by floods. The method is now being applied in Malaya to long deep drains and the central stream of main ravines. It works in steep gradients or in sluggish flat lands, and in sand or clay, and can be successfully employed above and below rocky waterfalls if these are stone-packed. The drains are regarded as semi-permanent [*cf.* **28** 223]. It has been found that though water spurts out of them during storms and floods and rushes along the surface, damaging the vegetation, it returns to the tunnel when the rains have abated and rarely leaves permanent damage. When a drain subsides, it is better to make a second one above it than to open it up and repack it. It is best not to pack deep drains up to the level of the ground on each side, partly because of expense and partly because the course of the drain will become obscured by vegetation. If seepages occur in the channel, they should be covered with fascine packing at right angles to the direction of flow and at an angle of 45° to the side of the drain. The cost of applying the method, which is low, is discussed.

DAVEY (T. H.). **Report of the Sir Alfred Jones Laboratory, Freetown.**—*Rep. med. Serv. Sierra Leone 1938* pp. 54–57. Freetown, 1939. [Recd. 1940.]

A survey of the mosquitos of the Protectorate of Sierra Leone was begun in February 1938. Around each Government medical station,

six or more mosquito breeding places of different types and six or more houses were chosen to be examined regularly for larvae and adults, respectively. The results of the survey for each month up to December 1938 are summarised in tables. Among 8,600 larvae and 1,280 adults examined, 46 species were represented, of which 9 were Anophelines. *Anopheles gambiae*, Giles, of which 1,174 larvae and 745 adults were taken, was by far the most abundant Anopheline. *A. funestus*, Giles, was next in abundance among the adults, 152 being obtained, but not among the larvae. In addition to the survey of the Protectorate, a somewhat similar one was made of the stream that appears to be the chief breeding place of Anophelines that infest the western outskirts of Freetown and some other places of importance. Larvae of *A. gambiae* and *A. funestus* were abundant in some parts of the stream, but its turbulence during the months of heavy rain (July–October) was sufficient to inhibit breeding almost entirely. It is therefore suggested that breeding in the stream would be controlled if its condition during the heavy rains were simulated by intermittent flushing. In the larval collecting places selected for observation throughout the Protectorate, the number of Anopheline larvae was reduced during the heavy rains, but breeding then occurs in temporary pools, which are such favourable sites for *A. gambiae* that adults of this species are more abundant in houses than during the dry season.

The study of fungous infections in *A. gambiae* was continued during 1938 [*cf. R.A.E.*, B **27** 65], and a number of additional Anophelines and other mosquitos were found infected in nature. Mortality among infected larvae is very high.

Two attempts to isolate a strain of Marseilles fever from batches of *Rhipicephalus sanguineus*, Latr., have failed. It is thought probable that this disease is present in the Colony on account of the existence of a small number of patients with fevers of the typhus type whose sera agglutinate Proteus OX_2 in high dilution.

VARGAS (A.) & FREIRE (F.). **Novos processos para avaliar a área de vôos dos anofeles.** [New Methods of measuring the Range of Flight of *Anopheles*.]—*Ann. paulist. Med. Cirurg.* **39** no. 1 pp. 3–7. São Paulo, 1940. (Abstr. in *Trop. Dis. Bull.* **37** no. 11 p. 784. London, 1940.)

Experimenting in Brazil with the method of Weathersbee and Hasell [*R.A.E.*, B **27** 79], the authors found that immersion of mosquito larvae in solutions of methylene blue (0·5 or 0·25 parts per 1,000) for 18–48 hours is sufficient to colour the thorax and abdomen of the adults developing from them. They also found that some Anopheline larvae can live for days in the weaker solution, thereafter completing their development into coloured adults. They then attempted to colour natural breeding places with the idea of measuring the range of dispersal of the Anophelines emerging from them. On one or two occasions it was possible by this means to obtain recognisably coloured adults of *Aëdes* and *Culex*, but *Anopheles argyritarsis*, R.-D., and *A. tarsimaculatus*, Goeldi, showed no evident stain. mfterwards, Anopheline larvae were kept for 48 hours in a solution of methylene blue in the laboratory and then returned to their original breeding places. This method was successful.

KITSELMAN (C. H.) & GRUNDMANN (A. W.). **Equine Encephalomyelitis Virus isolated from naturally infected** *Triatoma sanguisuga* **LeConte.**—*Tech. Bull. Kans. agric. Exp. Sta.* no. 50, 15 pp., 1 fig., 15 refs. Manhattan, Kans., 1940.

The virus of the western strain of equine encephalomyelitis was isolated in June and July 1940 from 4 out of 6 collections of *Triatoma sanguisuga*, Lec., obtained in Kansas from pastures in an area in which horses were grazing and in which several cases of the disease had occurred. This bug is common throughout the State and over much of the region in which equine encephalomyelitis has occurred, and is known to feed on horses in nature. Details are given of the experiments by which the virus was identified. The bugs from each group that were not used for its direct isolation were placed in cages in contact with susceptible guineapigs. One of the guineapigs succumbed 28 days after entering the cage, and the virus was isolated from the brain and is now in its third serial passage.

An appendix includes a brief history of equine encephalomyelitis and a note by R. C. Smith on the biology of *Triatoma sanguisuga*. It is a tropical and sub-tropical species, but its range extends northward through the Great Plains area. All stages live in rodent burrows and nests. The bugs feed largely on the blood of vertebrates and have been reported as attacking other insects also. They are nocturnal and are attracted to light. They overwinter as partly grown nymphs or adults. Eggs are deposited from June to September, there being only one generation annually.

DAVIS (W. A.). **A Study of Birds and Mosquitoes as Hosts for the Virus of Eastern Equine Encephalomyelitis.**—*Amer. J. Hyg.* **32** no. 2 Sec. C pp. 45–59, 39 refs. Lancaster, Pa., 1940.

In the summer of 1938, an epidemic of eastern equine encephalomyelitis involving more than 300 horses occurred in New England, a small epidemic occurred in man [*cf. R.A.E.*, B **27** 161], and the virus was isolated from two wild pheasants and a pigeon. A study was, therefore, made to ascertain which of the local mosquitos could act as vectors and whether mosquitos could become infected through feeding on birds. In the work on the first question, 16 species of mosquitos native to Massachusetts were obtained for study, and *Aëdes aegypti*, L., a known vector, was included as a control. The virus used was originally isolated from a fatal human case, and produced characteristic symptoms in young mice. Domesticated strains of *A. aegypti* and *Anopheles quadrimaculatus*, Say, and wild strains of *Aëdes atropalpus*, Coq., and *Culex pipiens*, L., were bred in the laboratory ; the other species were reared from larvae taken in nature, except *Mansonia perturbans*, Wlk., adults of which were trapped.

The experimental procedure was as follows : Mosquito pupae were placed in a dish inside a battery jar covered with gauze. A small slit in the gauze was plugged with cotton-wool, sugar solution on cotton-wool was placed beside the plug, and both were covered by a Petri dish. From 3 to 5 days after the adults had emerged, the water in the dish and the sugar solution were removed and the mosquitos starved for 1 or 2 days to ensure feeding later. An animal infected by subcutaneous inoculation in time for the virus to reach a high titre in the blood was placed on top of the jar and kept still by one of several methods

described so that the mosquitos could feed on it through the gauze. At the end of the feeding period, a tube was inserted through the slit in the gauze, and all females that had not fed were sucked out and discarded. One that had fed was also removed, and a mixture of its abdominal contents and saline was injected intraperitoneally into young mice. If the mice died with typical symptoms of encephalomyelitis on the second or third day, it was assumed that the mosquitos had obtained an infective meal ; if the mice remained well, the insects were discarded. At varying times after the blood-meal, the mosquitos remaining in the jar were again starved for a day and then fed on a normal mouse to test their ability to transmit the virus. At the end of the experiment, all the live mosquitos were ground in saline and injected into mice to determine the presence or absence of virus. Such a test was considered satisfactory if the mosquitos had been kept alive at temperatures above 26°C. [78·8°F.] for 11 days after their infective meal. Tests in which no transmission was obtained were not considered adequate unless more than 50 mosquitos had fed.

In all, 28 satisfactory tests were completed with 10 species of mosquitos. All the species of *Aëdes* among these, namely *A. aegypti*, *A. vexans*, Mg., *A. cantator*, Coq., *A. sollicitans*, Wlk., *A. atropalpus* and *A. triseriatus*, Say, transmitted the virus [*cf.* **22** 225]. The shortest and longest periods between an infective meal and transmission were 9 and 41 days. A fatal infection was produced by the bite of a single mosquito on six occasions, and one mosquito infected three animals. Mosquitos became infected from feeding on either birds or mammals and transmitted the virus to other birds or mammals regardless of the species from which they obtained it. Transmission was not effected by *M. perturbans*, *Anopheles punctipennis*, Say, *C. pipiens* or *C. salinarius*, Coq. The virus persisted in the Anopheline as long as the insects remained alive, but disappeared from the other species within a few days. It is considered probable that most species of *Aëdes* are potential vectors of eastern equine encephalomyelitis, but that the importance of each in nature is determined by such factors as feeding habits, flight range, abundance and perhaps seasonal variations. Two lots of *A. aegypti* tested during the winter failed to transmit the virus, although they were maintained at summer temperature. The flight range of mosquitos of the genus *Aëdes* exceeds that of members of any other genus. The need for multiple blood-meals may be significant. During the summer, *Aëdes sollicitans* reared in the laboratory formed eggs after a single meal and refused to feed more than once. It seems unlikely that species that have only one brood a year and occur as adults early in the season are important vectors, as the disease does not become widespread until mid-summer. Consideration of the abundance, distribution and feeding habits of mosquitos in Massachusetts indicates that, if these insects are the natural vectors of equine encephalomyelitis, *A. vexans* was probably the chief vector in New England in 1938.

A study of the epidemic supported the suggestion of previous workers that birds serve as a reservoir from which mosquitos become infected. The rate of flight of the latter makes it improbable that they could account for the rapid spread of infection, and no evidence of transmission by contact was found. Studies showed that mourning doves (*Zenaidura macroura*), redwings (*Agelaius phoeniceus*), cowbirds (*Molothrus ater*) and grackles (*Quiscalus quiscula*), all migratory birds that are often seen in close association with livestock, might have virus

in their blood for a few days (less than four) following subcutaneous inoculation, without showing obvious signs of infection. Sparrows died following intracerebral inoculation and usually after subcutaneous inoculation if the dose was sufficiently large. There was evidence that the virus multiplied in them. A sparrow, a pigeon and two cowbirds were infected by mosquitos, and birds of these three species and also a redwing served as a source of infection to mosquitos. One of the cowbirds died 4 days after being bitten, having shown no sign of disease except weakness, and the other died 49 hours after the infective bite. The sparrow died in 18–24 hours. The pigeon showed no signs of the disease, but had the virus in its blood 24 hours after being bitten.

HUFF (C. G.). **Quantitative Studies on Size, Variability, and Growth Rates of Oöcysts of different Strains of Avian Malaria.**—*Amer. J. Hyg.* **32** no. 3 Sec. C pp. 71–80, 2 figs., 15 refs. Lancaster, Pa., 1940.

The following is based on the author's summary and conclusions: Basic data on oöcyst size are given for strains of *Plasmodium cathemerium* and a strain of *P. relictum* in *Culex pipiens*, L., at temperatures of 22, 25 and 28°C. [71·6, 77 and 82·4°F.]. Some data on *P. lophurae* in *Aëdes aegypti*, L., at 28°C. are also included. In *P. cathemerium*, the strains differed in maximum size of oöcyst and in infectiousness for *C. pipiens*. Although temperatures are shown to play some part in the susceptibility of the mosquitos, the problem of the measurement of this effect is complicated by possible differences in the fluctuating genetic constitution of the stock of mosquitos. Significant differences were found in the mean sizes of oöcysts in individual mosquitos kept under the same conditions of temperature and humidity. Analysis of variance showed that the variance of oöcyst size between mosquitos was significantly greater than the variance within mosquitos, in the sixteen lots so analysed. While the variation introduced by individual mosquitos makes analysis of growth curves for the parasites difficult, the best evidence indicated that the rates of growth are not exponential, but decrease progressively as the oöcyst approaches its maximum size.

ROSS (H. H.). **The Rocky Mountain "Black Fly," *Symphoromyia atripes* (Diptera: Rhagionidae).**—*Ann. ent. Soc. Amer.* **33** no. 2 p. 254–257, 9 figs., 1 ref. Columbus, Ohio, 1940.

Between 1920 and 1930 in the Cascade Mountains in southern British Columbia and again in 1936 in the same range in Washington, the author and others suffered extreme discomfort from the bites of *Symphoromyia atripes*, Big. The flies apparently attacked only on sunny days and in the open. They approached noiselessly, often in swarms, but their sluggish movement and persistence when biting made them easy to kill. Aldrich has recorded the same Rhagionid as being very troublesome to horses in Washington in August 1905. Nothing is known about its life-history or immature stages. It is distributed from California, Utah and Colorado to Alaska, is one of the common species of its genus in that region and appears to be especially abundant in parts of the Cascade Range. The mouth-parts are described in detail.

BATES (M.). **The Nomenclature and Taxonomic Status of the Mosquitoes of the *Anopheles maculipennis* Complex.**—*Ann. ent. Soc. Amer.* **33** no. 2 pp. 343–356, 41 refs. Columbus, Ohio, 1940.

Students of the problem agree that the mosquitos formerly included under the single taxonomic concept of *Anopheles maculipennis*, Mg., form a group of more or less independent populations distinguished by various physiological and morphological characters [*cf. R.A.E.*, B **23** 152, etc.]. There is little agreement, however, regarding the taxonomic categories to which these populations should be assigned, and some twenty latinised names have been applied to them. The author therefore reviews the definitions and general usage of the categories biotype, form, variety, race (geographical and biological), subspecies and species, and recapitulates the points of difference between the *maculipennis* populations, particularly those observed by himself in material from Italy and Albania. He found seven types of eggs, the only difficulties in classification being between *melanoon*, Hackett, and *subalpinus*, Hackett & Lewis, and between *typicus*, Hackett & Missiroli, and *messeae*, Flni. In the first case, the distinction seemed to be purely geographical and thus subspecific, and in the second there appeared to be a phenotypic variation due to temperature. All other characters were found to be definitely correlated with the egg differences. The branching of the antepalmate hair of the fourth and fifth abdominal segments [**28** 96] seemed to be characteristic for each population, and it was often possible to identify individual larvae with some certainty. Except for *sacharovi*, Favr (which is shown by hybridisation to be an integral part of the complex [**27** 158]), the adults are not readily distinguishable by morphological characters, though there are differences in male genitalia in the case of some of the populations. Physiological differences, correlated with egg types, occur in the ecology of the larvae and their survival in salt solutions [**28** 29] and in the epigamic behaviour [**28** 85] food reactions [**27** 162] and hibernation [**27** 77] of the adults. Hybrids between the populations show various degrees of sterility [**27** 158].

The author considers that these differences have not been recently evolved and are, in the case of some of the populations, of specific value. He gives an annotated list of the available names in the *maculipennis* group, followed by a proposed classification, with notes on the distribution and synonymy of the species and subspecies he recognises, which may be summarised as follows. *A. maculipennis*, Mg. (*typicus*, Hackett & Missiroli; *basilei*, Flni.) and *A. messeae*, Flni., are widely distributed in Europe, but the latter does not extend so far south as the former. *A. melanoon melanoon*, Hackett, appears to be limited to the Italian peninsula, while *A. melanoon subalpinus*, Hackett & Lewis, is found in Spain, northern Italy and throughout the Balkans. *A. labranchiae labranchiae*, Flni. (*pergusae*, Missiroli; ? *sicaulti*, Roub.) seems to be limited to Italy, Spain, certain Mediterranean Islands and north Africa, while *A. labranchiae atroparvus*, van Thiel (*fallax*, Roub.; *cambournaci*, Roub. & Treill.) is widely but sporadically distributed in central Europe. Their ranges are known to overlap in one district of Italy only. *A. sacharovi*, Favr (with questionable synonyms *elutior*, Martini, *elutus*, Edw., *martinius*, Shing., and *relictus*, Shing.) is a form occurring in the Near East. The name *A. occidentalis*, D. & K., is appended to cover the American representatives of the group, but it is thought that they may include

several subspecies, or even species (*aztecus*, Hffm.). The names *alexandrae-schingarevi*, Shing., *lewisi*, Ludl., and *selengensis*, Ludl., are considered to be of uncertain status.

Bishop (E. L.). **Cooperative Investigations of the Relation between Mosquito Control and Wildlife Conservation.**—*Science* **92** no. 2383 pp. 201–202. New York, N.Y., 1940.

Among the problems created by the conversion of the Tennessee River into a series of large reservoirs in 1933 and investigated during 1939 was that of the control of *Anopheles quadrimaculatus*, Say [*cf.* *R.A.E.*, B **24** 130, 291]. The routine use of Paris green applied by aeroplane at the rate of about 1 lb. per acre caused no apparent injury to vegetation. Chemical analyses of soil samples showed arsenical residues accumulating in the bottom of the reservoirs in variable amounts. From a general study extending beyond the Tennessee valley and carried out by the Bureau of Fisheries, it was found that the quantity of arsenic accumulated in fish at the date of the investigation did not render them unfit for human consumption. Oils used as larvicides had little or no effect on vegetation or fish.

Chumakov (M. P.) & Seitlenok (N. A.). **Tick-borne human Encephalitis in the European Part of USSR and Siberia.**—*Science* **92** no. 2386 pp. 263–264, 7 refs. New York, N.Y., 1940.

The so-called taĭga or spring-summer encephalitis found and investigated in the Russian Far East [*R.A.E.*, B **27** 69, 239, 240] is transmitted by *Ixodes persulcatus*, Schulze. The disease is to some extent endemic in certain wooded localities, affecting chiefly people engaged in forest work. Its maximum incidence occurs at the end of May and beginning of June, preceding the hot season and the mass appearance of mosquitos [*cf.* **27** 70]. It has generally been held to be confined to the taĭga, but the authors, through the collaboration of local workers, have found that sporadic cases and localised outbreaks of similar diseases occur in several parts of the Russian Union, including European districts not in the forest zone, the season of incidence being May–September. The disease affected persons who had been attacked 1–2 weeks previously by *I. persulcatus*. The authors isolated from encephalitic patients four strains of the neurotropic filterable virus similar to that detected in ticks, which proved to be naturally infected at all stages of development and readily infected mice on which they were fed. Adult ticks collected before they had fed and allowed to engorge on laboratory animals produced offspring that contained a highly active virus. The virus, therefore, persists through the ovum and during metamorphosis, apparently propagating in the ticks without harming them. In a further series of studies, a similar virus was detected in the brains of hares and squirrels attacked by the ticks. All strains of the virus of tick-borne encephalitis studied were found to be identical with one another as well as with those of the Far East.

Fellton (H. L.). **Control of Aquatic Midges with Notes on the Biology of certain Species.**—*J. econ. Ent.* **33** no. 2 pp. 252–264, 3 figs., 12 refs. Menasha, Wis., 1940.

An account is given of investigations on Chironomids begun in July 1938 and of control operations against them carried out at the site of

the New York World's Fair. The creation during 1936 and 1937 of two fresh-water lakes, high in organic content, on what had previously been salt marsh meadow open to tidal action, had apparently produced optimum conditions for the breeding of certain species, and adults were abundant on the shores of the lakes in 1938. It was imperative that the numbers be considerably reduced before the opening of the Fair on 30th April 1939, and that the control be maintained for its duration. The Chironomids taken near the lakes or bred from larvae or eggs taken from them included nine species of *Chironomus*, of which the dominant ones were *C. lobiferus*, Say, and *C. cingulatus*, Mg., which were extremely abundant throughout the season, and *C. tenuicaudatus*, Mall., which became most abundant during the latter part of it, and *Procladius culiciformis*, L., *P. choreus*, Mg., and *Tanypus punctipennis*, Mg., which were quite abundant over the entire period.

The breeding area is described, an analysis of four samples of water from different depths and parts of the lakes is given, and the literature on the effect of a high organic content in water on Chironomid breeding is reviewed. To determine the proportions of the various species in typical environments, three samples of larval habitat (a dense mat of algae from underwater portions of a raft, marsh sod and grey clay from the lake bottom at a depth of 3 ft., and black sludge and decaying vegetation from the lake bottom at a depth of 5 ft.) were removed more or less intact, and midges bred from them. *C. lobiferus* and *C. tenuicaudatus* formed 47 and 39 per cent., respectively, of the populations in the algae, *C. lobiferus* formed 82 per cent. at 3 ft., and *C. lobiferus* and *C. cingulatus* formed 36 and 46 per cent., respectively, at 5 ft. In addition, samples from depths varying from $1\frac{1}{2}$ to 18 ft. were studied. *C. tenuicaudatus* was found almost exclusively amongst green algal filaments in shallow water or otherwise near the surface of the water, where dissolved oxygen, temperature and intensity of light would be relatively high. *C. lobiferus* was abundant in all parts of the lake except the black sludge at depths of 7 ft. or more. The larvae of *Procladius* and of *Tanypus* were distributed over the lake bottom in positions similar to *C. lobiferus*, except in the cleaner or shallower areas. *C. cingulatus* was the only species found in the black sludge at depths of 7 ft. or more. The egg masses of *C. lobiferus* and *C. cingulatus* were attached to a variety of materials at or just below the surface of the water, and contained an average of 1,768 eggs. Those of *Procladius* were generally lying on the lake bottom. Eggs of *C. cingulatus* deposited in the laboratory hatched in 42–72 hours. In the laboratory, all eggs of *C. lobiferus* and *C. cingulatus* in masses taken from the lakes, and exposed to the air for up to 72 hours but resting on a moist surface throughout, hatched after being covered with water. When the surface was allowed to become dry, all hatched when the period of exposure did not exceed 6 hours, but none when it was 7 or 8 hours.

The larvae of all the species concerned obtain their oxygen from the water. Those of the genus *Chironomus* construct tubes in which most of their life is spent and obtain food by means of a flow of water through the tubes induced by their own undulatory movements. They have also been often observed to feed on inorganic matter close to the tube. It was found that they can exist for considerable periods in a moist environment not covered with water. The larvae of *P. culiciformis*, *P. choreus* and *T. punctipennis* live free in the mud at the bottom of the water. The *Procladius* larvae were never observed to be predacious, but those of *Tanypus* were often seen feeding on

newly hatched larvae of *Chironomus* inside the egg masses. The larvae of *C. lobiferus* and *C. cingulatus* pupate within the tube, and the pupae, which are relatively inactive, remain on the lake bottom until shortly before the adults emerge. The pupae of *C. tenuicaudatus*, and of *Procladius* and *Tanypus*, are much more active. Notes are given on the results of rearing experiments and the duration of adult life of various species, and also a detailed description of oviposition by a female of *C. tenuicaudatus*. It is estimated that the life-cycle of *C. lobiferus* and *C. cingulatus* occupies about 30 days in mid-summer, and that that of *C. tenuicaudatus* is probably of the same length or slightly shorter. However, more than three weeks have been known to elapse between the emergence of the first and last adults of a culture started from a single egg mass. The life-cycle of *Procladius* spp. lasts about four weeks in early spring and three in mid-summer.

In laboratory toxicity tests, chiefly with *C. lobiferus*, in which a considerable number of materials was tried, promising results were obtained with Paris Green, white arsenic, sodium chloride and derris. Pyrethrum [*cf. R.A.E.*, B **20** 111] was discarded as derris appeared superior, and this was the material chosen. Sufficient derris was applied to form a dilution of 0·3 parts rotenone per million in the water in the small lake and 0·5 parts in the larger lake, and 1 part copper sulphate per million was dissolved in the lakes at the same time to kill the algae that served as food and shelter for the larvae and to increase the power of the derris by reducing the alkalinity of the lake water. The spraying outfit and procedure are described. The results were striking, particularly in the larger lake. Many dead or dying larvae were soon observed on the water, thousands of others were washed ashore and the bottom of the lake was soon covered with dead larvae. The intervals between treatments were based on the life-cycle of the species involved. The measures were effective against the species of *Chironomus*, but the control of *Procladius* spp. was not nearly so satisfactory and in the laboratory, an emulsion of 80 per cent. orthodichlorobenzene and 20 per cent. sulphonated castor oil gave much better kill. In the lakes, their numbers were considerably reduced by spraying the places on the lee shore where the pupae congregated with derris or the pyrethrum and kerosene emulsion used for the control of mosquitos.

GOODHUE (L. D.) & SULLIVAN (W. N.). **Toxicities to the Housefly of Smoke from Derris and Pyrethrum.**—*J. econ. Ent.* **33** no. 2 pp. 329–332, 1 fig., 2 refs. Menasha, Wis., 1940.

In tests on the toxicity of the smoke from burning derris and pyrethrum to *Musca domestica*, L., the flies were exposed for an hour at 25–29°C. [77–84·2°F.] to the smoke from a mixture of 50 per cent. finely ground derris or pyrethrum, 30 per cent. maize stalks and 20 per cent. sodium nitrate. The derris contained 4·9 per cent. rotenone and 17·1 per cent. total chloroform extractives. The pyrethrum contained 0·76 per cent. total pyrethrins. The derris mixture, burnt at rates of 0·5, 2·0 and 4·0 oz. derris per 1,000 cu. ft., gave average mortalities of 32, 93 and 95 per cent. in 72 hours and the pyrethrum mixture at 4·0, 8·0 and 12·0 oz. pyrethrum per 1,000 cu. ft. gave 14, 32 and 74 per cent. Judged by the dosage required to give 50 per cent. kill, derris was more than ten times as toxic as pyrethrum. The effect of smokes from derris and pyrethrum marc, which were

included as controls, was slight. There was little or no residual effect from the smoke. In tests with *Periplaneta americana*, L., pyrethrum at the high concentrations was about as toxic as it was to flies, but derris had little or no effect. In a single test with *Aphis rumicis*, L., however, the derris was very toxic, the rate being 4 oz. per 1,000 cu. ft. Although pyrethrum cannot be effectively dispersed by this method, the satisfactory results with derris make it appear that other easily decomposed or non-volatile materials might also be used as fumigants. The advantages and disadvantages of applying insecticides in the form of smoke are discussed, and it is pointed out that if an aerosol could be prepared, without burning, a great advance would be made [*cf. R.A.E.*, B **28** 239].

HEADLEE (T. J.). **The Relative Effects on Insect Metabolism of Temperatures derived from Constant and Variable Sources.**—*J. econ. Ent.* **33** no. 2 pp. 361–364, 3 refs. Menasha, Wis., 1940.

Quotations are given from two papers by earlier workers [*R.A.E.*, A **15** 532; **16** 642] in which insect development was found to be more rapid at varying than at the intermediate constant temperatures, and the results of a study made by the author with overwintered larvae of the codling moth [*Cydia pomonella*, L.], an account of which was published in 1929, are summarised. The experiment was begun on 15th April 1928, and whereas 21 days were required for maximum emergence at a temperature varying from 50 to 76°F., the same stage was reached at a constant temperature of 63°F. in 13 days. In November 1938, the relative effects of constant and varying temperatures on *Aëdes aegypti*, L., was studied. The mechanism used to regulate the temperatures is briefly described. The days elapsing between hatching and maximum emergence at constant and variable temperatures and (in brackets) the percentages of larvae reaching the adult stage were: 24·5 (17·3) and 23 (32) at 65 and 50–80°F.; 13 (25·2) and 20 (60) at 75 and 60–90°F.; and 10 (74) and 28 (2·1) at 85 and 70–100°F.

The cause of the apparent inconsistency of these results is discussed. The characteristic curve of reaction of insects to external factors is sigmoid; if the factor is temperature, the top and foot curves represent the regions of retardation due to high and low temperatures, respectively. If, therefore, the variable range under examination extends into either of these curves, the speed of metabolism is likely to be reduced, and development to take longer at the varying than at the constant temperature. If the constant is too close to either curve, retardation is likely to result. The effect of varying and constant temperatures appears to depend, therefore, on where they lie in the temperature scale of the insect or stage concerned.

SCHROEDER (H. O.). **Habits of the Larvae of *Gasterophilus nasalis* (L.) in the Mouth of the Horse.**—*J. econ. Ent.* **33** no. 2 pp. 382–384, 3 refs. Menasha, Wis., 1940.

Investigations were carried out in Iowa in 1938 on the habits of the larvae of *Gastrophilus nasalis*, L., between their entry into the mouth of the horse at the beginning of the first instar and their appearance in the duodenum in the second [*cf. R.A.E.*, B **26** 151]. Eggs of a uniform age were collected by exposing egg-trap halters [**26** 153] for

a short time, and were incubated at 95·7°F. and a relatively high humidity. To have a large number of larvae ready for use at the same time, the hatching of fully incubated eggs was delayed by maintaining them at 55–57°F. Five horses were infested by transferring larvae to the lips within 15 minutes of hatching. In examinations of the horses, which were killed at varying periods after infestation, the larvae were found invading the spaces around and between the teeth below the gum line and behind the alveolar process of the gums. Necrosis of the tissue involved resulted in the formation of pus pockets extending into the tooth sockets. As many as 12 larvae were removed from one such pocket, and the same one often contained maturing larvae of both the first and second instars. Younger first-instar larvae were sometimes found at the sides of the teeth, concealed by the gums, with no apparent lesion. No larvae were found burrowing in any other mouth tissue. From one of the horses infested by placing all larvae between the lips near the left commissure, 19 larvae were recovered from around the teeth on the right cheek, 16 from around those on the left and 1 from near a front tooth. It was estimated that the minimum and maximum durations of the first instar were a little less than 18 days and about 24 days, respectively, and that a short period following the moult was passed in the mouth before the larvae passed to the duodenum, some larvae probably remaining in the mouth for 28–30 days in all.

Cotterell (G. S.). **Preliminary Investigations on the Fly Population of Stable Manure Heaps and Measures for the Prevention of Breeding.**—*Pap. 3rd W. Afr. agric. Conf. Nigeria June 1938 Sect. Gold Coast* **1** pp. 118–125, 2 pls. Lagos [1940].

As mixed farming, including the keeping of cattle, is being advocated in the Gold Coast, experiments were carried out to ascertain to what degree Muscoid flies breed in manure heaps and in which parts of the heaps breeding occurs, the effect of fermentation, and the extent to which breeding might take place in droppings in the field. Nearly all the Muscoids found were *Musca domestica*, L., or other Muscids, most of which, it is thought, will prove to be small examples of this species, which are often bred from drying material and cannot reproduce. An investigation of an old existing dump consisting chiefly of horse manure and bedding stacked on a concrete floor and surrounded by concrete walls on three sides showed that breeding of *M. domestica* was inhibited where the temperature of the manure was high owing to fermentation, and occurred chiefly in the surface layers. It also appeared that larvae were constantly being added to the heap with fresh manure. As this dump was not considered typical, further observations were made on a heap of cattle manure stacked on a beaten earth floor under cover and prepared over a period of three weeks. All but one of the 184 larvae and pupae taken in it were in the surface samples, which were taken from a depth of 3 ins. only and in which the temperature was less than 50°C. [122°F.]. It was also shown that the larvae could pupate successfully in the hard beaten earth under, and particularly at the immediate edge of, the heap. Extensive breeding was found to take place in the field in cattle dung 1–3 days old and a certain amount in dung less than 24 hours old. More flies were produced per cubic foot from dung 1–3 days old than in any part of the dung heap under observation. Two experiments

were carried out to test the possibility of flies breeding in heaps of cattle dung in which fermentation is complete. The heaps were caged for 18 or 19 days to allow flies to emerge; they were then re-exposed for 5 days, after which they were caged again and emergence once more observed. In one experiment, 276 Muscids emerged during the first period and 282 during the second, but in the other, only one fly (*Stomoxys* sp.) appeared during the second period, though 583 Muscids emerged during the first.

Previous workers have ascertained that house-flies cannot live in manure with a temperature of 114·8°F. In the present observations, temperatures as low as this were recorded only in the immediate surface layer and in manure in which fermentation was complete. It is therefore suggested that breeding may be restricted to some extent if the depth of the cooler surface layer is reduced by close packing each time fresh manure is added. In dry weather, it may be necessary to sprinkle a little water on the heap before it is beaten down. Breeding can also be considerably reduced by covering heaps with oiled Hessian cloth. In an experiment with two identical heaps, the covered and uncovered ones produced, respectively, 66 and 276 flies. To prevent infestation of dwelling houses, cattle should not be allowed to graze within 700–800 yards of them unless all dung is collected daily.

KOBAYASHI (H.). **Diapause of** *Fannia canicularis*. [*In Japanese.*]—*Zool. Mag.* **52** no. 3 pp. 118–119. Tokyo, 1940.

Observations on *Fannia canicularis*, L., in Japan showed that some of the eggs laid in October and November give rise to adults in December, while others do so in February–April of the following year. Eggs laid in December give rise to adults in May, but some of those laid in April do so in May and others in July. This variation in development is attributed to a diapause in the prepupal stage in some individuals.

KONO (H.) & TAKAHASHI (H.). **Tabanids hindered Railway Construction in Oshima, Hokkaido.** [*In Japanese.*]—*Oyo-Dobuts. Zasshi* **12** no. 1 pp. 21–29, 2 figs. Tokyo, 1940.

Tabanids appeared in great numbers in Oshima (Hokkaido) in August 1939 and attacked men engaged in railway construction so severely that the work had to be discontinued for a week. Nine species were taken, of which *Tabanus iyoensis*, Shir., was the most abundant, followed by *T. sapporoensis*, Shir. Their attacks were more severe on cloudy days than in fine weather, and occurred about noon.

BARANOV (N.). **Stand der Kolumbatscher Mückenforschung in Jugoslawien.** [The Position of Investigations on the Golubatz Fly in Jugoslavia.]—*Z. Parasitenk.* **11** pt. 2–3 pp. 215–234, 4 figs., 17 refs. Berlin, 1939. [Recd. 1941.]

This review of present knowledge concerning *Danubiosimulium columbaczense*, Schönb., in Jugoslavia [*cf. R.A.E.*, B **28** 95, etc.] contains sections dealing with the morphology, biology, outbreaks and migrations of this Simuliid, its control, the effects of its bites on cattle, and the organisation of research work on it.

WEYER (F.). **Zur Frage der Konstanz in der Zusammensetzung natürlicher Populationen von** *Anopheles maculipennis*. [On the Question of Constancy in the Composition of natural Populations of *A. maculipennis*.]—*Z. Parasitenk.* **11** pt. 2–3 pp. 357–370, 5 refs. Berlin, 1939. [Recd. 1941.]

In this paper, the author discusses from his work on the distribution of the races of *Anopheles maculipennis*, Mg., in Germany [*R.A.E.*, B **27** 78] some of the difficulties that arise in estimating the composition of local populations of these races. Sufficient is known of the distribution of the races for fairly good estimates to be made from the examination of a very few egg-batches if the results confirm expectations, and a fair degree of constancy in the selection of types of breeding places can be assumed. Thus, race *messeae*, Flni., is known to occur throughout the greater part of the interior of Germany, and its presence in any given locality in this region can easily be verified.

In most cases, however, populations are mixed. Although race *atroparvus*, van Thiel, is described as coastal, it is generally accompanied by race *messeae*, and, in some Baltic districts, by race *maculipennis* (*typicus*). More or less slight variations in the relative frequency of these races occur, particularly at a little distance from the coast. In identifying such populations, the author has therefore aimed at the examination of egg-batches from at least 30 females.

Erroneous estimates of populations may be made unless account is taken of the facts that females of race *messeae* taken indoors oviposit within a shorter time than do those of race *atroparvus*, that females of race *atroparvus* enter and leave hibernation sites earlier than those of race *messeae*, and that females of the two races are not uniformly distributed in buildings [*cf.* **27** 77], while variation in the composition of populations results from climatic conditions, as prolonged dry or rainy weather affects the suitability of the breeding places.

GEBAUER (O.). **Das Verhalten der grossen Dasselfliege** (*Hypoderma bovis*, **de Geer**) **im Tierversuch und die perkutane Invasion der Larve des ersten Stadiums.** [The Behaviour of *H. bovis* in Experiments with Cattle and the percutaneous Entry of the first-stage Larva.]—*Z. Parasitenk.* **11** pt. 2–3 pp. 391–399, 7 figs., 1 fldg table, many refs. Berlin, 1939. [Recd. 1941.]

An account is given of investigations carried out in Germany in 1939 on certain aspects of the bionomics of *Hypoderma bovis*, DeG. Thirty-one larvae that dropped from infested cattle were placed in a vessel containing soil with a grass covering and kept under conditions of bright sunlight. The degree of moisture of the soil did not affect development. The larvae bored small grooves on the soil under the grass and pupated in them about 12 hours after leaving the host. The pupae did not project above the surface of the soil. The duration of the pupal stage averaged 26·4 days, and 15 males and 15 females emerged. In the insectarium, the adults were rather inactive in the morning, climbing high up on grasses and other objects and remaining there. Flight increased with a rise in temperature ; its direction was mainly towards the sun, and was not influenced by introducing calves into the cage. Females brought near to the feet or belly of a calf at once crawled upwards over the hairs and oviposited after travelling a few centimetres. The eggs were fastened by an adhesive to the tips

of the hairs, and were more numerous in shaded parts. The calves appeared to be very little disturbed by the presence of the flies. Paired males and females survived for 2–4 days, while unpaired individuals lived somewhat longer. It was observed that in many cases oviposition was stimulated by a twitching of the skin of the calves.

Newly hatched larvae placed on the back of the human hand crawled down the hairs to the skin, and when one came in contact with a small lesion made for the purpose, it entered it and bored its way downwards. No pain was caused, and after 4½ hours, when examination was made, the larva had reached the stratum papillosum. A larva was also found in the conjunctive tissue 6 mm. below the surface of the skin of a calf at the place where eggs had been laid 6 days previously. These observations confirm the view that percutaneous penetration is the natural method of entry.

ZUMPT (F.). **Die *Rhipicephalus*arten der USSR, ein Beitrag zur Variabilität in der *sanguineus*gruppe. I. Vorstudie zu einer Revision der Gattung *Rhipicephalus* Koch.** [The Species of *Rhipicephalus* of the USSR, a Contribution to Variation in the *sanguineus* Group. First preliminary Study for a Revision of the Genus *Rhipicephalus* Koch.]—*Z. Parasitenk.* **11** pt. 2–3 pp. 400–409, 6 figs., 5 refs. Berlin, 1939. [Recd. 1941.]

The following is based on the author's summary: The species of *Rhipicephalus* recorded from the Russian Union are *R. sanguineus*, Latr. (including the typical form), *R. schulzei*, Olen., and *R. bursa*, C. & F. *R. rossicus*, Yak. & Kohl-Yak. [*cf. R.A.E.*, B **11** 190] is a subspecies of *R. sanguineus*, and *R. pumilio*, P. Schulze [**23** 139] a synonym of *R. schulzei*.

HASE (A.). **Ueber *Triatoma dimidiata* (Hemiptera Triatomidae). I. Teil.**—*Z. Parasitenk.* **11** pt. 2–3 pp. 419–429, 7 figs., many refs. Berlin, 1939. [Recd. 1941.]

An account is given of the technique by which *Triatoma dimidiata*, Latr., was bred in the laboratory in Germany from eggs received from Salvador in 1938. The adults of both sexes and the nymph are described, together with the process of pairing and the way in which the nymphs cover themselves with a coating of débris so that they resemble their background. The adults are able to fly [*cf. R.A.E.*, B **23** 41], and were easily induced to do so in the laboratory.

MCCULLOCH (R. N.). **Observations on the Toxicity of some Insecticides as Stomach-poisons to Blowfly Maggots.**—*J. Aust. Inst. agric. Sci.* **6** no. 2 pp. 105–108, 1 ref. Sydney, 1940.

An account is given of observations, carried out between 1930 and 1936, on the relative toxicities to blowfly larvae (*Lucilia cuprina*, Wied., *L. sericata*, Mg., or *Calliphora stygia*, F.), and the relative rapidity of action, of a number of insecticides tested in minced meat. The results, together with those of certain experiments in the field [*R.A.E.*, B **20** 232] and considerations of chemical stability and cost, which are not dealt with here, led to the conclusion that none of the substances

tested (which included Paris green, nicotine sulphate, sodium fluosilicate, derris and boric acid) showed promise as a substitute for sodium arsenite or calcium arsenite in the jetting mixtures used for the control of blowflies on sheep in Australia.

LENNOX (F. G.) & HALL (D. L.). **The Use of Oil of Citronella for the Protection of Lambs against Blowfly Strike.**—*J. Coun. sci. industr. Res. Aust.* **13** no. 2 pp. 65–73, 1 fig., 4 refs. Melbourne, 1940.

Treatment of sheep, and particularly lambs after marking, with some material that would offset their attractive odour, would appear to be a desirable way of protecting them from blowfly strike. Theoretically, dressings may render the attractive odour ineffective by reacting chemically with the substance producing it, by masking it without chemical interaction, or by repelling the flies that would otherwise be attracted. This paper consists of an account of an investigation in Australia into the effectiveness of dressings of essential oils. These probably act in one of the last two ways. The 37 oils compared in the preliminary tests with carrion as the attractant were classified in three groups, highly repellent, slightly repellent and non-repellent. Examination of the composition of those falling into the first group, the efficiency of which was confirmed by re-testing, failed to show any correlation between repellency and the predominance of particular chemical compounds. As citronella oil was the cheapest of them, it was chosen for further study. Medicinal paraffin, which penetrates the fleece well and is non-irritant, was used as a base in some of the experiments, but as it accumulates dust on the fleece and promotes infection, and is moreover too expensive for field use, an aqueous soap solution was considered more suitable ; soap is known to increase the solubility in water of citronella and other essential oils. The solution was prepared by dissolving 1 part (by weight) soft soap in 5 parts water by mixing thoroughly and heating almost to boiling, slowly stirring in 1 part citronella oil, further warming until the preparation was uniformly transparent and syrupy, adding 3 parts water and allowing to cool. To make a 5 per cent. solution, this preparation was diluted with an equal volume of water.

In tests in an insectary containing a pure fly population of *Lucilia cuprina*, Wied., two areas on the backs of sheep were made attractive by placing in the fleece a plug of absorbent cotton-wool soaked in a solution of indole and ammonium carbonate. One of these areas was surrounded with a ring of the test solution of citronella oil and the other with the solvent to serve as control. A 50 per cent. paraffin solution of citronella oil gave complete protection for at least a fortnight, and a 10 per cent. solution in paraffin or aqueous soft soap, though much less effective, conferred significant protection for a short period. There was no significant difference between the solutions prepared with the two solvents. The difference between the numbers of the egg-batches laid daily on the test control areas decreases with time, on account of the gradual loss of the citronella oil by evaporation.

In 1938, half of the lambs of the experimental flock at Canberra were treated immediately after marking by swabbing the wounds and the surrounding fleece with 5 per cent. citronella solution. Bleeding carried the solution away from the raw areas so that prevention of oviposition on the exposed tissues depended on the protective effect of the vapour from the oil on the surrounding skin and fleece. The

lambs were examined at intervals and the presence of live maggots on the raw tissues was recorded as strike. Of 20 untreated ewe lambs and 16 untreated wethers, 18 and 13, respectively, were struck, while the corresponding figures for equal numbers of treated ones were 14 and 7. In 1939, the concentration of citronella oil was increased to 10 per cent. and swabbing was replaced by spraying to avoid spreading blood to the surrounding fleece. Half the tails were cut at the second joint as in the previous season and half at the third. Of the lambs with medium tails, 6 out of 10 untreated ewes and 5 out of 9 untreated wethers were struck, as compared with 2 out of 10 and 1 out of 9 treated ones. Those with long tails comprised 19 ewes and 17 wethers and 10 of each were treated, but the only ones struck were 2 untreated ewes. It thus appears that considerable protection is afforded by leaving the tail long. Concentrations higher than 10 per cent. were not tested because they are too costly and might irritate the skin. Graphs showing how long after treatment the strikes occurred in the medium-tailed groups in both years demonstrate that not only is the ultimate protection resulting from the treatment appreciable, but also that, at all stages during healing, the incidence of strike is lower amongst the treated animals. The wounds were attractive from the third to about the seventh day, but the increased effectiveness that would result from re-treatment on the third day would not justify the extra handling. The reduction of strike resulting from treatment with citronella-oil solutions is attributed to repellent action and interference with the normal oviposition stimulus, antiseptic and stimulant action, which promotes healing of the wounds, and possibly contact toxicity for the newly hatched larvae. The aqueous soap solutions penetrate the fleece well, but promote wetting and consequent leaching when the sheep are exposed to rain.

Entomological Problems.—*Rep. Coun. sci. industr. Res. Aust.* **13** (1938–39) pp. 15–22. Canberra [1940]. **Animal Health and Nutrition Investigations.**—*T.c.* pp. 26–42.

Investigations on sheep blowflies in Australia were continued by the Divisions of Economic Entomology and of Animal Health and Nutrition during the year 1938–39 [*cf. R.A.E.*, B **27** 195]. The attractiveness of sheep was shown to be graded according to age, lambs being most attractive and aged sheep least, but there is no significant difference between ewes and wethers. A comparison between the untreated breech and artificial attractants [*cf.* **25** 52; **27** 196] showed that alcoholic indole on the sheep was as attractive as a stained and wet, moderately susceptible breech, but decidedly less so than a scouring or struck breech. Scouring made the breech of wethers as attractive as that of urine-soiled ewes. Of a series of supposed repellents, tested by the new and apparently promising method of smearing them on the fleece round areas artificially rendered attractive, two, citronella oil [*cf.* preceding abstract] and a crude preparation of sandalwood oil, were found worthy of further trial.

In continued toxicity tests, stomach poisons were incorporated in artificial media [**28** 57]. Two methods of assessing their potency were developed for general use. The first is to determine the minimum dose that will inhibit the growth of newly hatched maggots. By this method, the compounds of arsenic and selenium are the most potent.

The second is to determine the speed at which maggots are killed by particular concentrations of the poisons. In these tests, some of the organic poisons, particularly nicotine, rank highest. A considerable number of poisons were graded by both methods. A third promising one, which has so far been used only with arsenic, is to determine the minimum time required for maggots to ingest a lethal dose of poison from a medium containing a given concentration. There was a great variation in the toxicity of various compounds of arsenic, the most remarkable being between calcium arsenite, which was the most toxic, and calcium arsenate, which was the least. In studying contact toxicity, full-grown maggots were used. Varying the concentration, time of exposure, temperature, etc., was found to influence the position rather than the form of the toxicity curve, and when several liquids were compared under different conditions, their order of toxicity remained the same. A survey of various contact poisons showed that solvents of fats and waxes are particularly toxic to *Lucilia cuprina*, Wied., that the contact toxicity values of essential oils are correlated with their content of carvone and carvacrol, and that tar-distillate fractions increase in toxicity with volatility and tar-acid content.

Complete records of strike incidence in the experimental flock have now been kept for six years, and a considerable amount of data has been obtained, the outstanding points of which are as follows: The average annual number of breech strikes per 100 sheep was 108, an indication of the amount that may be expected in an unprotected flock. The effectiveness of the protective measures already available is indicated by the fact that strike in well managed commercial flocks rarely exceeds a quarter of this amount. The three conformation classes [**26** 6; **28** 103] showed well-marked differences in strike incidence consistently every year, but the extent of the differences was reduced by the development of a dressing that prolonged the interval between strikes in sheep of the more susceptible groups. Polwarth ewes are less susceptible than A class pure Merino ewes. Observations over a period of four years indicated that the effects of Mules' operation [**27** 197, etc.] are permanent. The incidence of fleece rot is closely correlated with age, being only significant, in the seasons under consideration, in the lambs and occasionally in the two-tooths.

It has been found that in the larva of *L. cuprina* and several other species, the reaction of the crop is the same as that of the food, the anterior part of the midgut is faintly alkaline, the middle section strongly acid, the posterior part weakly acid to distinctly alkaline, and the hindgut distinctly alkaline. Iron is absorbed and stored by a narrow band of cells in the acid section of the midgut. It has recently been shown that copper is also absorbed in the acid section of the midgut. Should this phenomenon prove to be general, it should be possible to devise a dressing containing a poison, such as arsenic, in a form that is absorbed by the acid midgut, but is insoluble and harmless to the sheep in the relatively alkaline conditions of strike wounds.

Studies of the life-history of *Melophagus ovinus*, L., were begun by the Division of Animal Health and Nutrition. Of 100 pupae observed, adults emerged from 63 (59 on the 19th and 22nd days and 4 on the 24th day). A higher proportion failed to emerge in February, when the weather was excessively hot, than in March and April. Observations on the effect of temperature and humidity indicated that 30°C. [86°F.] and 70 per cent. relative humidity can be adopted as the standard conditions for testing the viability of pupae in dipping trials and for

rearing supplies for experimental purposes. Females known to be 3–4 days old were capable of being fertilised when placed with males for 24 hours. Only one pupa is deposited at a time, and the interval between the depositing of successive pupae is generally 7, or sometimes 8, days. Several pupae can be produced after a female has paired once. The adults move about considerably on the body of the sheep, and if any attempt is made to confine them to a given area, they soon die. The reason for this is not understood. The movements of various individuals on different sheep are being recorded. Most of the pupae are deposited on the underside of the neck in front of the brisket, though a few are found on other parts of the body. As the wool in front of the brisket is commonly left half an inch long or more at shearing, many pupae are left on the sheep.

Ants and Fowls.—*Agric. Gaz. N.S.W.* **51** pt. 5 p. 271, 1 fig., 1 ref. Sydney, 1940.

On various occasions, fowls in New South Wales are reported to have died as a result of eating ants of the genus *Crematogaster*. G. T. Hungerford, Veterinary Officer, Department of Agriculture, New South Wales, has recorded deaths of fowls caused by feeding on ants of this genus and also *Chalcoponera*, which swarm in large numbers after rain. He states that death occurs only over a period of 24–36 hours, and that two species, *Chalcoponera metallica*, F. Sm., and *Iridomyrmex detectus*, F. Sm., have been recorded as causing mortality amongst fowls in Queensland.

Freeman (M.), Derrick (E. H.), Brown (H. E.), Smith (D. J. W.) & Johnson (D. W.). **Studies in the Epidemiology of Q Fever. 5. Surveys of Human and Animal Sera for *Rickettsia burneti* Agglutinins.**—*Aust. J. exp. Biol. med. Sci.* **18** pt. 3 pp. 193–200, 1 fig., 4 refs. Adelaide, 1940.

The examination of bandicoots (*Isoodon torosus*) for agglutinins for *Rickettsia burneti* [*R.A.E.*, B **28** 227] was continued in Queensland to a total of 180 bandicoot sera, of which 39 were found to agglutinate. Agglutinins were found in the sera of 36 out of 107 bandicoots taken at Cowan Cowan on Moreton Island as compared with only 3 out of 73 taken on the mainland. The mammals on the island and their parasites are of few species. *Haemaphysalis humerosa*, Warb. & Nutt., the only tick found, was numerous on the bandicoots and was also found on the native rat, *Mus* (*Rattus*) *culmorum youngi*. There were at least three species of Trombidiid mites and two Laelaptids. The abundance of bandicoots and of *H. humerosa* has apparently provided an ideal environment for the free propagation of *R. burneti*. Among other bush animals tested, agglutinins were found in the sera of one of the native rats and two water-rats (*Hydromys chrysogaster*), all from Cowan Cowan. The serum of one of 24 cows belonging to a farmer who had had Q fever six months previously was positive. Surveys of abattoir workers at Brisbane and of forestry workers at a place about 70 miles further north showed the occurrence of infection with *R. burneti* among them, and demonstrated that human infection is sometimes inapparent. The failure to find agglutinins in the blood of 186 men who had camped at Cowan Cowan suggests that *H. humerosa* does not readily attack man, and consequently is not likely to be a common cause of direct human infection.

Senevet (G.). **Quelques Ixodidés de la Guyane française. Espèces nouvelles d'***Ixodes* **et d'***Amblyomma*.—*VI Congr. int. Ent. Madrid 1935* **2** pp. 891–898, 4 figs., 1 ref. Madrid, 1940.

Records are given of 5 Ixodids collected in French Guiana, mostly near Cayenne, in 1934. Two are described as new ; they are *Amblyomma bouthieri*, for which no host is given, and *Ixodes luciae*, which is doubtfully recorded from a dog.

Webb (J. L.). **The Occurrence of Rickettsia-like Bodies in the Reduviid Bug** *Triatoma rubrofasciata* **and their Transmission to Laboratory Animals.**—*Parasitology* **32** no. 4 pp. 355–360, 1 fig., 6 refs. London, 1940.

As lesions similar to those found in typhus fevers and also rickettsia-like bodies were noticed in heart sections of white mice that had died after inoculation with the dejecta of *Triatoma rubrofasciata*, DeG., the bugs were suspected of harbouring a rickettsia transmissible to laboratory animals, and an examination was made accordingly. All the adult bugs available, which had been collected in huts in two localities [in Mauritius], showed rickettsia-like bodies, which were found in all the organs examined, including the malpighian tubes, ovaries and salivary glands, as well as various muscles. The pleomorphism and staining characteristics of these bodies and their failure to grow on ordinary laboratory media support the view that they are rickettsiae. Similar organisms were found in newly hatched and older nymphs and in unhatched embryos, and it is concluded that they can be transmitted hereditarily. Inoculations into small laboratory animals produced pathological lesions that caused death in some cases. White mice seemed to be more susceptible than rats or guineapigs. The forms found in the bugs and some of the experimental animals are described. The bodies have been maintained for five passages through guineapigs.

Soni (B. N.). **Preliminary Observations on the Bionomics of the Goat Warble Fly (***Hypoderma crossii* **Patton).**—*Indian J. vet. Sci.* **10** pt. 3 pp. 280–283, 1 pl., 1 fig., 7 refs. Delhi, 1940. **The Structure of the Mouth-parts of Young Larval Forms of** *Hypoderma crossii* **Patton.**—*T.c.* pp. 291–292, 1 pl., 3 refs.

Hypoderma crossi, Patt., has been recorded from goats in the Salt Range district of the Punjab [*R.A.E.*, B **10** 231], hilly tracts of the North-West Frontier Province [**27** 244], Baluchistan [**18** 124] and the Kashmir and Kulu valleys, and full-grown larvae received from Sind showed that it is also prevalent in that Province. It has not been recorded outside India. In the Punjab, 90 per cent. of the goats in some herds were infested, and sometimes 150–200 larvae were recovered from a single animal. Surveys in the Punjab and North-West Frontier Province indicated that the period from pupation to oviposition lasts from mid-March to mid-August. Very young larvae were found in the subcutaneous fascia of the goat's back as early as the third week of August, and second-instar larvae between early October and the middle of November. Full-grown larvae keep appearing in tumours in the back of the host until the middle of March, so that the total period for which larvae occur in the back is nearly seven months. There is no migratory stage, and it is probable that,

as Patton suggests [**10** 231], eggs are laid in the long hair and the larvae enter the skin below, and remain there. Sheep are occasionally infested, but short-haired goats are not, and extensive surveys afforded no evidence that cattle were ever attacked [*cf.* **12** 62].

Hu (S. M. K.). *Culex pallidothorax* **Theobald as a Carrier of** *Wuchereria bancrofti* **Cobbold.**—*Lingnan Sci. J.* **19** no. 4 pp. 543–547, 9 refs. Canton, 1940.

Fourth-instar larvae and pupae of *Culex pallidothorax*, Theo., were found in Shanghai city in May 1939 in a concrete trough half-filled with rain-water containing decaying leaves and other organic débris. It was the first time that the author had taken this species in or round Shanghai, though many likely breeding places had been examined over a period of 7 years, and no further examples were found in this or similar troughs examined during the rest of 1939. From the larvae and pupae taken, 137 adults were obtained, of which 84 were females. These were kept in screened lamp chimneys and fed on soaked raisins for a few days, after which they were starved for one day and then given the opportunity for an hour to feed on a man harbouring a light infestation of microfilariae of *Filaria* (*Wuchereria*) *bancrofti* in his blood. Only one of the 84 fed, but five more did so after being starved for another day. The remaining 78 did not survive a third day's starvation. The six females were kept and fed on soaked raisins and were dissected after 23–24 days, so that there was time for filarial larvae in them to develop to the infective stage. The one that had engorged at the first opportunity was negative, but the other five contained from 2 to 4 infective larvae, all of which were normal in appearance. As *C. pallidothorax* is not a common household mosquito in Shanghai, it is not likely to play an important part in the transmission of *F. bancrofti* there. It can, however, be found breeding in considerable numbers and in many different types of water in other parts of China.

Gould (G. E.) & Deay (H. O.). **The Biology of six Species of Cockroaches which inhabit Buildings.**—*Bull. Indiana agric. Exp. Sta.* no. 451, 31 pp., 13 figs., 24 refs. Lafayette, Ind., 1940.

This bulletin contains data, gathered during a study lasting for five years, on the biology of *Periplaneta americana*, L., *Blatta orientalis*, L., and *Blattella germanica*, L., all of which are well-known household pests, *Supella supellectilium*, Serv., which has become an important pest in the United States during the last 10 years, *Parcoblatta pensylvanica*, DeG., an occasional pest of houses situated near woods, and *Periplaneta fuliginosa*, Serv., which is common in the southern States, has been present in Indiana for five years and is a potential pest of houses in the north.

The following is based on the authors' summary: *Periplaneta americana* showed a decided response to environmental factors when reared under room conditions. During winter when relative humidity was low, many egg capsules failed to hatch. The egg stage lasted 88 and 37 days at average temperatures of 70 and 83·7°F., respectively, the averages of duration and temperature being 58 days and 76°. In a chamber with a constant temperature of 86°F. and a relative humidity of about 70 per cent., 121 capsules hatched in an average of 32 days. The nymphal period varied from 285 to 971 days

(average 519) under room conditions, and 145 to 265 days (average 194) in the constant temperature chamber. Egg production and nymphal development occur throughout the year. On an average, females lived 441 days under room conditions and produced 58 capsules, of which 33 were fertile, and about 14 nymphs emerged from each fertile capsule. The optimum temperature range of *Blatta orientalis* was the same as that of *P. americana*, but there was a tendency to a seasonal cycle, adult emergence being greatest in the spring. At room temperatures, some nymphs overwintered twice and matured 9–10 months after others from the same capsule. The incubation period ranged from 81 days at an average temperature of 70°F. to 42 days at 85°F., with an average of 57 days at 78°F. The average female lived 140 days and produced 9 capsules, of which 5 were fertile, and about 15 nymphs hatched per fertile capsule. *Blattella germanica* developed throughout the year and completed its life-cycle in 90 days during the summer or under conditions of high temperature. The capsule was carried during incubation, which lasted on an average 28·4 days at 76°F. The average developmental period of 109 nymphs was 103 days at 76°F. Adult females lived on an average 260 days and produced 6 capsules, of which 4·4 were fertile and each of which contained 30 eggs.

Capsule production of *S. supellectilium* and the percentage of capsules to hatch dropped greatly during periods of low temperature. Under room conditions, capsules hatched in 90 days at 73°F. and 49 days at 82°F., while in the constant temperature chamber, the average incubation period was 44 days at 81·4°F. and 57 days at 79·7°F. The nymphal stage lasted 161 days under room conditions at about 75·8°F. and 92 days under constant temperature conditions at about 84°F. For all individuals reared, the average was 123 days at 79·3°F. Under room conditions, the average female lived 198 days and produced 15 capsules, of which 6 were fertile and from which 13·2 nymphs hatched. Most individuals of *Parcoblatta pensylvanica* reached maturity in early spring. Nymphs maturing in the first year developed in about 9 months, but some did not mature until the second year. Adults lived only during the summer. The egg stage lasted 34 days at 80°F. Females lived about 140 days and produced about 20 capsules, from which, on an average, 31 nymphs hatched. The egg stage of *Periplaneta fuliginosa* lasted 58 days at 76°F., and the nymphal stage 344 days. The average female lived about 200 days and produced 17 capsules, from which 18·3 nymphs hatched.

Papers noticed by Title only.

Wendt (A.). *Cimex hemipterus* **F.** *flavifusca* **form. nov.** (**Hex., Rhynchota**) [on a bat in eastern China].—*Z. Parasitenk.* **11** pt. 2–3 pp. 199–201, 3 figs. Berlin, 1939. [Recd. 1941.]

Morishita (K.) & Kobayashi (E.). **On the** *Anopheles* **of Hainan** [list of 14 species, with keys to adults]. [*In Japanese.*]—*Kagaku no Taiwan* **8** no. 3 pp. 89–94. Taihoku, 1940.

Yamashita (J.) & Tosa (K.). **Injuries and some Problems of** *Hypoderma lineatum* **De Vill.** [in cattle] **in Manchuria.** [*In Japanese.*]—*Oyo-Dobuts. Zasshi* **12** no. 1 pp. 30–38. Tokyo, 1940. [*Cf. R.A.E.*, B **27** 21.]

SIMMONDS (H. W.). **Investigations with a View to the Biological Control of Houseflies in Fiji.**—*Trop. Agriculture* **17** no. 10 pp. 197–199. Trinidad, 1940. **Summary of a Report on the recent Mission of Mr. H. W. Simmonds to Java, Malaya, Mauritius and Madagascar.**—*Agric. J. Fiji* **11** no. 1 p. 21. Suva, 1940.

It is stated in an editorial note in the first paper that it is a slightly revised form of the report submitted by Simmonds on his investigations into the problem of the biological control of house-flies (*Musca domestica*, L.).

Until about 30 years ago, these flies were very abundant in Fiji, and annual epidemics of bacillary dysentery and the prevalence of typhoid and eye disease were attributed to them. In 1910, their numbers diminished through the accidental introduction of the predacious ant, *Pheidole megacephala*, F. In certain districts, however, especially where cattle were kept, they continued to assume plague numbers in the hot season, and since 1931, localised outbreaks of bacillary dysentery have reappeared and eye disease of cattle has occurred. In 1928, it was shown that these summer outbreaks were usually due to the fact that the flies breed in cattle droppings [*cf. R.A.E.*, B **16** 253], which they did in Java and Malaya also. Experiments then indicated that under conditions prevalent from November to March, the surface of the droppings does not harden quickly enough to enable the ants to pass over it and remove the eggs before the larvae hatch and move to the interior. In the course of these investigations, two parasites were found, *Spalangia muscidarum*, Rich., and *Eucoila* sp. In 1929, the dung-beetle, *Copris incertus* var. *prociduus*, Say, was introduced and established [**17** 235], but it does not appear to be of much value in Fiji. Large numbers of the predacious Muscid, *Mesembrina meridiana*, L., were imported in 1931, but though they appeared to survive for one generation they met with unfavourable weather and were not seen again. An African parasite of house-fly pupae, *Dirhinus* sp., was imported in 1936, and it bred freely in pupae of house-flies and Sarcophagids in the laboratory and was liberated in large numbers, but it is doubtful whether it will prove of much value.

Investigations on the natural enemies of the house-fly in Malaya, Java and Natal were made in 1938–39. Collections of the beetle fauna of cattle droppings in Java were made in 1938, and *Hister chinensis*, Quensel, was found in the first collection. Laboratory tests showed that a single individual could eat 10–20 full-grown fly larvae in 24 hours, and that beetles could survive without food for 15 days with a low mortality rate. The Histerid was introduced into Fiji later in the year [**27** 155], but early reports suggest that weather conditions have been extremely unfavourable to it. It was also introduced into the Solomon Islands from Java for the control of *Lyperosia* [*exigua*, de Meij.] A consignment was taken over by Love who liberated some, obtained eggs and larvae from others kept for breeding and also recovered larvae in the field. Another consignment was sent from Java to Samoa, where Muscid larvae are exceedingly abundant in cattle droppings. *Copris incertus* var. *prociduus*, which was imported from Hawaii in 1933, is now abundant everywhere in Samoa. In Malaya, *H. chinensis* was scarce, probably owing to soil conditions. A minute red ant was observed removing Dipterous eggs, but Dipterous larvae were sometimes found in abundance, and biological control seemed less effective than in Java. Though house-flies are usually comparatively

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scarce in Java and Malaya, they were abundant in a number of localities in Malaya, generally near dairy farms, whereas in Java, they were abundant only in a few places where cattle were few or absent and conditions were therefore unfavourable for dung-beetles. In Natal, some Muscid larvae were found in cattle droppings, and house-flies, though not a serious pest, were fairly numerous in some places. A large and powerful Histerid, *Placodes caffer*, Erichs., was present though apparently not abundant. The droppings were attacked by many species of Coprids, which often completely removed them in a few hours. In some districts, *Onitis alexis*, Klug, was the most abundant species, and in others *Copris urus*, Boh. It is considered that these large species might usefully be introduced into Fiji.

The second paper includes a very brief summary of the investigations in Java and South Africa in 1938–39 and the introduction of *Hister* (*Platylister*) *chinensis* into Fiji, Samoa and the Solomon Islands, together with the statement that Simmonds had no difficulty in recovering this Histerid in the neighbourhood of Suva 15 months after its release there.

MAYNE (B.). **Graphic Reproduction of the Life Cycle of the Malaria Parasite in the Mosquito Host.**—*Bull. Nat. Inst. Hlth* no. 170, iii + 15 pp., 27 pls. (3 col.), 7 refs. Washington, D.C., Supdt. Documents, 1938. Price 40 *cents*. [Recd. 1940.]

In addition to a very fully illustrated account of the developmental cycle of the parasites of human malaria in man and Anophelines, a description is given of the method used in preparing for examination the anatomical structures of the mosquito involved in the development of the parasite.

SHANNON (R. C.) & DE ANDRADE (G. C.). **Dry Season Observations on the African Mosquito, *Anopheles gambiae*, in Brazil in 1938.**—*Amer. J. trop. Med.* **20** no. 5 pp. 641–668, 10 figs., 6 refs. Baltimore, Md., 1940.

A detailed account is given of a survey of breeding foci of *Anopheles gambiae*, Giles, in north-eastern Brazil [*cf. R.A.E.*, B **28** 194, etc.] carried out between 17th October and 22nd December 1938 (the latter part of the dry season). The main areas studied were the Jaguaribe basin and a stretch of the coast of Ceará extending for about 130 miles from the frontier of Rio Grande do Norte. Brief visits were also made to two points to the north-west in Ceará and an island in Maranhão, but larvae were not found there or along the coast, but only in the Jaguaribe basin. The area in which breeding was taking place extended from the mouth for some 170 miles up the Jaguaribe and for considerable distances up some of its tributaries. Forecasts based on the availability of suitable breeding places are made of the probable future extent of spread of the mosquito [but it has since been found (*loc. cit.*) to have spread further along the Jaguaribe than was expected].

The invaded territory has marked wet and dry seasons, the latter lasting from about early July to early February. Mountains extend along the western and southern borders of the area. There is a flat

coastal plain, and there are also large alluvial plains composed of siliceous clay, which favours the formation of rain pools. Much of the interior is hilly country with thin top soil on which only scrubby deciduous trees and cacti grow. The rivers are reduced to pools in the dry season; the other types of ground water are springs, scattered lakes, scattered river-bed reservoirs and subterranean and seepage waters. There were also numerous shallow wells excavated in the river beds, and irrigation ditches in the subterranean water areas, which proved to be the chief breeding places. Nearly all the larvae found were in small collections of ground waters with a surface area of less than 22 sq. ft. and a depth of 8 ins. or less, and free or nearly free from vegetation. Where wells occurred in the neighbourhood of the natural residual pools in the river beds, the mosquitos appeared definitely to prefer to oviposit in the wells. Those studied were sand-lined, while the pools had a layer of black mud. Both were free of obvious animal contamination. However, abundant breeding was observed in two natural pools divided into numerous pockets by the trampling of animals and rather strongly fouled with their discharges. The larvae were abundant in the hoof-prints and pockets in the shallower parts, but scarce in the deeper areas with unbroken water surfaces. At both localities, there were also numerous wells with larvae as well as larger and deeper residual pools without them. Only a few indigenous species of *Anopheles* occur in the region, owing to the restricted breeding conditions.

STRATMAN-THOMAS (W. K.). **The Influence of Temperature on *Plasmodium vivax*.**—*Amer. J. trop. Med.* **20** no. 5 pp. 703–715, 6 refs. Baltimore, Md., 1940.

The following is based on the author's summary and conclusions: The development of *Plasmodium vivax* in *Anopheles quadrimaculatus*, Say, was completed within the temperature range of 15–17°C. [59–62·6°F.] to 30°C. [86°F.]. The period in which it was completed varied from 8 to 38 days. The lowest temperature at which it was completed in 8 days was 28°C. [82·4°F.]. Shortly after feeding on a gametocyte carrier, *A. quadrimaculatus* was completely sterilised of its plasmodial infection at 37·5 °C. [99·5°F.] in 2 to 3 hours; at temperatures of 1–10°C. [33·8–50°F.], 2½ days were necessary. During the growth of the oöcysts (7 to 13 days after the infective feed), exposure of the mosquito to 37·5°C. for 18 to 24 hours aborted their development, only a very small percentage of these mosquitos ultimately showing sporozoites in their salivary glands. At 1–10°C., 24 days were required to interrupt oöcyst development. When development was complete and sporozoites were present in the salivary glands, 24 hours' exposure to 37·5°C. had a marked inhibitory effect on the infectivity of the sporozoites in human inoculation, but this effect was not observed in Anophelines kept at 1 to 7°C. [44·6°F.] until after 50 days. Anophelines that developed their malarial infection when incubated at the extreme temperatures possible for the completion of the exogenous cycle were infective. The failure of *P. vivax* to develop at constant temperatures above 30°C. and the fact that a period of 24 hours at 37·5°C. will destroy it in all but a very small percentage of *A. quadrimaculatus* have a bearing on its transmission during the summer months. The data presented show that in certain localities the oöcyst may survive the winter and complete its development in the following spring.

Le Van (J. H.). **Measures instituted for the Control of *Aëdes aegypti*.**—*Amer. J. publ. Hlth* **30** no. 6 pp. 595–599, 4 figs., 5 refs. New York, N.Y., 1940.

The usual method of controlling *Aëdes aegypti*, L., in towns is to inspect the houses periodically and eliminate all possible breeding places. In Key West, Florida, however, rainwater storage cisterns are the only source of drinking water, and when organised work against *A. aegypti* was planned in 1938 it was impossible to require all cisterns to be made mosquito-proof immediately. The finding of *Gambusia holbrooki* in cisterns into which it had been introduced in small numbers in 1935 suggested that, contrary to previous belief, it could feed in dark, covered cisterns, such as those common in Key West, and laboratory experiments showed that its consumption of mosquito larvae did not depend primarily upon the amount of light. It was, therefore, decided to stock every cistern in the city that was not mosquito-proof with one adult fish per sq. ft. of surface unless the householder refused consent. Shallow fresh-water wells were also stocked. To obviate criticism for possibly introducing contamination into the cisterns, the fish were kept overnight in chlorinated water containing enough hypochlorite to produce a chlorine residue of 0·1 to 0·15 parts per million. The pregnant females were more susceptible to injury during handling and chlorination than the delicate males, but with reasonable care little harm resulted to either.

All cisterns not stocked with *Gambusia* were sprayed every 10 days with sufficient kerosene to form an unbroken film on the surface. The use of the fish was successful, but they were not able to remove heavy infestations ; in such cases, the cistern was first sprayed with kerosene to kill the larvae, and the fish were introduced later to prevent re-infestation. Apparently the kerosene film was not harmful to them.

Breeding in flower containers in the Key West cemetery, which was extensive, was controlled by putting a pellet of a wet mixture of 1 part Paris green and 4 parts plaster of Paris into each vase. Houses in which adult mosquitos were found to be numerous were sprayed with a concentrated extract of pyrethrum in light oil.

Hoeppli (R.) & Ch'iang (I-hung). **The Louse, Crab-louse and Bedbug in Old Chinese Medical Literature with special Consideration of Phthiriasis.**—*Chin. med. J.* **58** no. 3 pp. 338–362, 1 fig., 24 refs. Peiping, 1940.

This paper contains detailed reviews of information on *Pediculus humanus*, L., including race *capitis*, DeG., *Phthirus pubis*, L., and *Cimex lectularius*, L., in Chinese literature since about 600 A.D. and brief accounts of the results of experiments with some of the methods there recommended for their control. Only a few showed any effectiveness, and complete mortality was obtained only with materials that were burnt so that the insects were exposed to a dense smoke from them. When used in this way, a powder composed of equal amounts of *Stemona tuberosa* and *Justicia gendarussa* gave complete kill of *P. humanus* in less than 5 minutes, while *Cydonia sinensis* and a mixture of *Piper longum*, *Aconitum uncinatum*, native arsenic bisulphide and potassium nitrate gave complete kill of *C. lectularius* in 5 and 4 minutes, respectively.

FAHRENHOLZ (H.). **Die Läuse der Schweine.** [Pig Lice.]—*Z. InfektKr. Haustiere* **55** pt. 2 pp. 134–154, 2 pls., 9 figs., 7 refs. Berlin, 1939. [Recd. 1941.]

The author differs from Ferris [*R.A.E.*, B **24** 15] as to the nomenclature of the lice that infest domestic pigs and modifies that followed by Ewing [**22** 206] by according specific status to *Haematopinus chinensis*, Fahrenh. He considers that since the common European domestic pig at the time of Linnaeus was not specifically distinct from the wild boar (*Sus scrofa*), the name *H. suis*, L., should be retained for the louse of the European wild boar, and *H. aperis*, Ferris [**24** 15] is therefore a synonym of it. Domesticated forms of the Chinese pig (*Sus leucomystax*) had, however, been introduced into Europe during the eighteenth century and have since largely replaced the domestic forms of *S. scrofa* in northern and central Europe. The louse found on these pigs is considered to be *H. chinensis*, which was described from *S. leucomystax* [*cf.* **9** 19; **22** 207]. Characters are given distinguishing *H. suis*, *H. chinensis* and *H. adventicius*, Neum., the typical host of which is considered to be *S. vittatus* in a wild state, which occurs in southern Asia and the Mediterranean basin. *H. suis germanus*, Fahrenh. (*germanicus*, Fahrenh.) [**9** 19; **22** 207] is considered a subspecies or variety of *H. chinensis* that occurs on domestic pigs of Chinese origin in various localities in the Province of Hanover.

In addition, descriptions are given of some lice infesting African wild pigs, *viz.*, *H. phacochoeri*, End., with subspecies *peristictus*, Kell. & Paine, from *Phacochoerus* spp., and *H. latus*, Neum., with subsp. *latissimus*, n., from *Potamochoerus* spp.

CARSE (G. M. D.). **Control of Lice on Pigs. Spray with Emulsified Neatsfoot Oil.**—*Agric. Gaz. N. S. W.* **51** pt. 7 pp. 357, 364, 2 figs. Sydney, 1940.

The essential qualities of an oil to be applied to pigs for the control of lice [*Haematopinus*] and those of the method to be used in applying it are given. At Hawkesbury Agricultural College, New South Wales, two applications of an emulsion prepared by dissolving 2 teaspoonfuls washing soda (or 4 teaspoonfuls soap powder) in 2 quarts water and stirring the solution into 1 quart neat's-foot oil are made at intervals of 10–14 days with a spray pump with a fine nozzle. This treatment is found to be effective. It is recommended that brood sows should be oiled 14 and 1–2 days before farrowing.

MACLEOD (J.). **The Moisture Balance of the Living Fleece in Relation to Blowfly Myiasis, with some Remarks on the Australian and British Conceptions of Susceptibility.**—*Ann. appl. Biol.* **27** no. 3 pp. 379–392, 15 refs. London, 1940.

The first part of this paper on the relation of fleece moisture to blowfly myiasis in sheep deals with observations in England on the actual humidity of a normal fleece climate and the moisture content of the fleece, the relation between the two, and the frequency of occurrence of unequilibrated free water in the fleece in nature [*cf. R.A.E.*, B **27** 112]. The second part is a discussion on the discrepancy between the

views of the workers in Australia and Britain of the rôle of moisture in the genesis of strike, which Lennox has already endeavoured to explain [*loc. cit.*].

The following is based on the author's summary of the results obtained on the first question : The relative humidity of the air at the base of the fleece of close-woolled and open-woolled sheep rarely exceeded 50 per cent. The basal fleece contained in summer a higher proportion of moisture than would fleece equilibrated with the adjacent air humidity, possibly through the rapid secretion of moisture-containing yolk. Equilibrium between fleece moisture content and adjacent air humidity is re-established in the middle of the fleece. Even under heavy rain, the basal fleece on the back of the sheep rarely becomes saturated. Penetration is greater in close-woolled than open-woolled sheep. The basal fleece air does not become saturated during rain, but its vapour pressure may increase if the moisture content of the basal fleece increases by diffusion down the fibres. Where the distal wool contains palpable free moisture in excess of its maximum absorbable amount, the basal humidity may be affected independently of the basal fleece content of absorbed moisture ; this increased humidity is probably due to evaporation of water droplets that have penetrated to the inner fleece, and must necessarily be ephemeral. Under normal conditions, the relative humidity of the basal microclimate must, therefore, exercise a continuous inhibitory effect on the survival of newly hatched larvae, or of eggs laid in the basal fleece [**23** 227]. It is the limiting factor in the establishment of strike. Except during rain, the total moisture content of the basal fleece affords a reliable index of the maximum humidity possible under the given conditions, and can, therefore, be used to assess the suitability of the area for the development of strike.

With regard to the second question, Lennox's objection to the British theory seems to rest on the possibility of the fleece air being saturated without the total moisture content of the fleece revealing the fact. However, he implicitly accepts the postulate that free moisture cannot remain in the fleece without the microclimate becoming saturated. His findings do not, therefore, invalidate the postulate that the fleece air must be over 90 per cent. saturated for strike to develop, but raise the question of whether such a condition is as rare as sampling methods indicate. Thus, they do not affect the fundamental question. The author summarises the essential causes of strike on suitable sheep according to the Australian view as wetness, wetness and bacterial activity, wetness and dermatitis from any cause, or wetness and bacterial activity resulting from dermatitis [**26** 5, 6]. The British workers show that strike consists of two independent processes, *viz.*, " blow " (the deposition of eggs), due to the presence of certain attractive odours on the sheep, among which ammoniacal and other decomposition products of bacterial activity are prominent ; and the development of myiasis, to which process the term " strike " in the restricted sense is applied, and which results from the presence in the basal fleece of a humidity high enough to enable the eggs to hatch and the young larvae to establish a lesion on the skin [**23** 227 ; **26** 192]. The author considers that much of the apparent discrepancy between the Australian and British views on the cause of strike arises from the failure of the Australian authors to make this distinction, " strike " being used in their writings to include the whole process. None of the evidence in favour of the necessity for palpable free

moisture, as distinct from a saturated fleece atmosphere, is valid when applied to strike in the restricted sense. With regard to the rôle of moisture, bacteria and dermatitis [**19** 258] in the initiation of strike, he considers that there is no fundamental difference between the Australian view that bacterial activity produces ammonia, which gives rise to dermatitis, as a result of which blow and strike develop, and the British view that bacterial activity produces ammonia, which gives rise to both blow and dermatitis, as a result of which strike develops. Both schools accept the probability that in nature bacterial activity frequently initiates the myiasis sequence. The Australians believe that moisture is necessary as an antecedent to bacterial activity and may be sufficient in itself without it, while the British workers have offered practically no postulates for the relationship between moisture and bacterial activity.

GOLIGHTLY (W. H.). **Factors influencing the Abundance and Size of *Psychoda* Species in Sewage Bacteria Beds.**—*Ann. appl. Biol.* **27** no. 3 pp. 406–421, 1 fig., 13 refs. London, 1940.

The following is taken from the author's summary: The insect fauna of the Huddersfield Corporation sewage bacteria beds has been studied and compared with that of Knostrop (Leeds) [*R.A.E.*, B **26** 113; **28** 150]. The structure and working of the beds together with the character and treatment of the sewage are described. The dominant element of the Huddersfield fauna is *Psychoda alternata*, Say, and its abundance is attributed to the absence of Chironomids, which compete with it at Knostrop [*cf.* **28** 151]. Its abundance at Huddersfield is such that treatment with creosote is undertaken to reduce its numbers, and this is shown to be more effective on fine-surfaced beds, which probably retain the fumes for a longer period.

By laboratory culture, temperature and crowding are shown to affect the size of *P. alternata* and *P. severini*, Tonn., wing length being employed as a criterion. Flies from the beds have been measured systematically, and the size of both species of *Psychoda* has been found to fall steadily from winter to midsummer and then rise again. Temperature and crowding are both potent factors in this, but the former is dominant. An artificial grouping of the data indicates that a rise of 2°C. [3·6°F.] in mean temperature entails approximately a reduction of 4 per cent. in wing length. It was found that the size of the female parent does not influence the size of the offspring, but small flies lay fewer and rather smaller eggs than large flies. It is suggested that this fact might stabilise the population at a given temperature and with unlimited food. There are strong indications that interspecific competition tends to reduce numbers, but intraspecific competition has a more pronounced effect upon the size of the individual.

MCCAULEY (W. E.) & RUSSELL (H. G.). **External Parasites of Sheep in Illinois: A Portable Dipping Vat.**—*J. econ. Ent.* **33** no. 3 pp. 547–550, 5 figs., 7 refs. Menasha, Wis., 1940.

There was little if any correlation between the quality of sheep and the presence of ectoparasites on them in 90 flocks examined in Illinois in June and July 1938 and 1939. Lambs were chosen at random from each flock for examination, as freshly-shorn mature sheep are almost

always free from infestation by the sheep ked, *Melophagus ovinus*, L. Only three flocks were found to be infested with lice, one seriously; all the lice were *Trichodectes ovis*, L. *M. ovinus* was by far the most important parasite; only 18·9 per cent. of the flocks examined were free from it, and 17·8, 28·9 and 34·4 per cent., respectively, showed light, moderate and severe infestations (less than 5, 5–20 and over 20 keds per head). It was considered that either a moderate or severe infestation justified dipping, and to encourage community effort, the portable dipping vat described in this paper was developed. It is in the form of a two-wheeled trailer that is attached to a car and is mounted on a frame constructed on the axle. It consists of a dipping tank along the left side with a platform, flush with the top, that provides standing room for the sheep at each end of the tank and a draining floor on the right side of it. The tank is 7 ft. long and 2 ft. wide at the top, 3 ft. long and 8 ins. wide at the bottom and $3\frac{1}{2}$ ft. deep. A light fence surrounds the whole, except for the left side of the tank and a small space at the back of the platform leading to a chute through which the sheep enter and leave. Another fence separates the tank from the draining floor, and a continuation of it is hinged to close either the exit from the draining floor or the entrance to the tank. The operator stands on a plank at a convenient height at the side of the tank, pulls each sheep into the liquid, holds it under for a moment to ensure thorough soaking and immerses the head. The sheep is then allowed to go up to the draining floor, which will accommodate 25–30 lambs or 15–20 mature sheep. The vat holds 150 U.S. gals., which is enough to dip 75–100 ewes and lambs.

Herms (W. B.), McIvor (B. C.) & Ladenheim (C.). **The Effects of Ingestion of Black Widow Spiders with Canned Food.**—*J. econ. Ent.* **33** no. 3 pp. 550–554, 2 refs. Menasha, Wis., 1940.

As several cases of gastric disturbance were alleged to have been caused by the ingestion of parts of the black widow spider, *Latrodectus mactans*, F., with canned foods, a series of tests was carried out in 1939 to determine the possible ill effects of eating canned foods into which spiders had been introduced before the food was subjected to the customary heat sterilisation treatment. Although it could not be confirmed that the species involved in the reported cases was *L. mactans* (only appendages being offered as evidence for identification), it was used in the tests as it is the most venomous species in the United States. D'Amour & others [*R.A.E.*, B **24** 247] showed that the toxicity of the venom could be destroyed by heating to 75°C. [167°F.] for 20 minutes or boiling for 5 minutes.

White mice (which are highly susceptible to the venom of *L. mactans*) remained normal after ingesting raw macerated venom sacs, whole spiders that had been boiled for 5 minutes or the liquid in which they had been boiled. When a spider was boiled for 8 minutes in tap water and macerated in the liquid, mice were not affected by inoculation of the supernatant fluid. Mice into which was inoculated the supernatant fluid resulting from the maceration of the abdomen or thorax (without the venom sacs) in distilled water developed typical but not severe symptoms of poisoning and recovered. A mouse died after the supernatant fluid resulting from the maceration of the whole body of a spider in distilled water had been inoculated into it. Living adult female spiders and females that had been dead for 4 days and 6 weeks

were placed singly in tins of spinach, which were then sealed and cooked in the usual way. Mice and guineapigs that ate the spinach and mice that ate the spiders or drank liquid from the spinach or into which the liquid was inoculated remained normal. A monkey [*Macacus rhesus*] remained normal after ingesting a spider that had been through the canning process in this way together with three spiders that had been coarsely macerated while still living.

GRANETT (P.). **Studies of Mosquito Repellents, I. Test Procedure and Method of evaluating Test Data.**—*J. econ. Ent.* **33** no. 3 pp. 563–565, 2 figs., 1 ref. Menasha, Wis., 1940. **II. Relative Performance of certain Chemicals and commercially available Mixtures as Mosquito Repellents.**—*T. c.* pp. 566–572, 9 refs.

The first paper contains a description of the procedure used in investigations begun in New Jersey in 1935 for testing the repellency of chemicals to mosquitos in the field in conditions as near normal as possible [*cf. R.A.E.*, B **13** 186; **27** 29] and the method of evaluating the results. An untreated arm or leg is exposed to biting for a definite period, usually 2 minutes. A measured quantity of the chemicals to be tested is then applied to the other arm or leg, and it is exposed for the whole period of the test while the untreated limb is exposed for 2 minutes, at intervals of $\frac{1}{4}$ to $\frac{1}{2}$ hour. The average number of bites per minute on the untreated area is called the " biting frequency " during the test period. The time in minutes required to obtain the first bite on the treated area is called the " repellent time." This time is the customary measure of the effectiveness of a repellent, but changing factors in the field cause it to fluctuate. An increase in biting frequency is correlated with a decrease in repellent time. Curves are given which show this relationship for four repellents. For any pair, the difference between their repellent times at a given biting frequency is approximately constant. At the highest biting frequencies, the decrease in repellent time is relatively slight. For purposes of comparison, the most satisfactory product developed during the investigation and known under the brand name of Sta-Way Insect Lotion is used as a standard. The " repellent rating " of a material is its repellent time expressed as a percentage of that of the standard at the same biting frequency. If the product is compared with the standard at several biting frequencies, the repellent ratings are averaged.

In the second paper, the literature on repellents is reviewed and the properties desirable in an ideal one are given. As none was available possessing anything approaching the qualities named, the investigations previously referred to were begun to discover or develop a better substance. Nearly 1,000 selected organic chemicals and chemical mixtures and about 40 proprietary products were tested, chiefly against *Aëdes sollicitans*, Wlk., and *A. cantator*, Coq., and the highly satisfactory one referred to in the previous paper was developed. Its active ingredients are diethylene glycol monobutyl ether acetate and diethylene glycol monoethyl ether and represent 65 per cent. of the whole, and it also contains ethyl alcohol, maize oil and perfume. Its repellent time (67–136 minutes at biting frequencies of 26–1) was considerably longer than that of any other usable compound tested, it has a pleasing odour, does not affect natural fibres, is non-irritant and not greasy or unsightly on the skin, and is effective against

many other blood-sucking pests, though usually not for so long as against mosquitos. On the other hand, it injures paints, varnishes, lacquers and certain plastics and affects cellulose-acetate fibre. The four products that ranked next to it in effectiveness were a proprietary product containing citronella oil, one containing synthetic organic repellents, undiluted citronella oil and medium-fraction steam-distilled pine oil. Their repellent ratings were respectively 80, 66, 65 and 59 per cent. The superiority of the proprietary product over undiluted citronella oil is attributed to its excessively viscous properties. The best of the pyrethrum mixtures tested [*cf.* **27** 203] had a repellent rating of only 41 per cent., and moreover, during part of the time for which the mosquitos were repelled from sucking blood they used to alight on the limb, pierce the skin and fly away without feeding. This piercing of the skin is almost as annoying as an actual bite.

Fisk (F. W.) & Le Van (J. H.). **Mosquito Collections at Charleston, South Carolina, using the New Jersey Light Trap.**—*J. econ. Ent.* **33** no. 3 pp. 578–579, 1 ref. Menasha, Wis., 1940.

In connection with the control of *Aëdes aegypti*, L., in Charleston, South Carolina, a mosquito survey with four light-traps was made from 5th August to 19th October 1939. The catches were generally much greater during warm than cooler weather, but the relation to rainfall was more obscure. Despite the short duration of the survey, 8 of the 22 species trapped and 1 of the 3 that were not trapped but were reared from larvae taken in Charleston County between 19th July and 1st November were not among the 27 recorded from South Carolina in a recent paper on the mosquitos of the south-eastern States [*R.A.E.*, B **28** 31]. Of the 14,748 adults trapped, 9,850 were *A. taeniorhynchus*, Wied.

Davis (D. H. S.). **Some Ecological Methods in Research on Bubonic Plague.**—*S. Afr. J. Sci.* **36** pp. 438–444, 4 refs. Johannesburg, 1939.

Plague is now enzootic in the rodent population over a large area of southern Africa, and cases in man, reflecting the minimum extent of this area, have occurred during the last 20 years in parts of eastern and north-western Cape Province, the Orange Free State and borders of Basutoland, the southern and western Transvaal, Bechuanaland, South-West Africa and Angola. Sporadic cases occur annually in widely separated parts of the Union, mostly when the veldt rodent population has reached a peak and is being reduced by epizootics of plague [*cf. R.A.E.*, B **24** 77]. Until recently, the main source of infection in man has been *Mastomys coucha*, but lately *Mus* (*Rattus*) *rattus* has been the source, particularly in the Orange Free State, and on some occasions, large numbers of this rat have died without any traceable infection in the veldt rodents. It thus appears that *Mastomys coucha* and *Mus rattus* are forming reservoirs independent of gerbilles.

Intensive ecological investigations were begun in September 1938 in an endemic plague area at Holfontein in the northern Orange Free State, with a view to devising quantitative methods of collecting data and of observing rodents and fleas in the field, and to using the results

of intensive work in this small area as a standard for comparison with conditions in other parts of the country. An outline is given of the methods used to estimate the fluctuation of population among gerbilles (*Tatera brantsi*), which is of importance for the determination of the exact point in the population's growth at which epizootics of plague and other diseases break out. The bases of the study are observations in the warrens, which are described, marking experiments, and field observations and experiments on the reproduction of gerbilles. The chief fleas on *T. brantsi* in this area are *Dinopsyllus ellobius ellobius*, Roths., *Xenopsylla eridos*, Roths., and *Chiastopsylla rossi*, Wtstn., and the chief species on *M. rattus* is *X. brasiliensis*, Baker. *D. ellobius* and *X. eridos* were occasionally taken on rats and *X. brasiliensis* on *T. brantsi*. As flea numbers are controlled mainly by climatic conditions, a fluctuation in the population is brought about by seasonal changes in the burrows and places where the fleas breed, and owing to the different characteristics of the various species, there is also a fluctuation in their relative abundance. In plague investigations, the degree of parasitism by fleas is usually expressed as the average number of fleas per rat examined (flea-index). This, however, gives no indication of the flea population of the habitat of the host. By collecting all the fleas living in each burrow system of a warren, the total number could be ascertained and related to the gerbilles inhabiting the warren, and if the relation was shown to be constant, the flea-index would provide an estimate of the whole population. To collect the fleas, the entrances of all burrows appearing to form part of one system are marked, and the loose soil lying at the bottom of each burrow for one foot from the entrance is removed and kept in a numbered bag. The first foot is then dug away and a second sample taken, and this procedure is repeated until the whole system has been excavated. The position from which each sample is taken is marked on a plan as the work proceeds. The samples are then sifted and the fleas collected, and the dust is kept to allow any eggs, larvae or pupae to develop. A description is given of an underground chamber where climatic conditions closely resemble those in gerbille burrows as indicated by records taken in an artificial burrow, which is also described; fleas can thus be studied in it in their natural climatic environment.

CHARI (M. O. T.). *Armigeres theobaldi* **breeding in** *Curcuma* **Flowers.**—*J. Malar. Inst. India* **3** no. 2–3 pp. 263–264. Calcutta, 1940.

Many larvae and pupae of *Armigeres theobaldi*, Barr., the breeding habits of which were previously unknown, were observed in the small quantities of water that had collected in flowers of *Curcuma pseudomontana* in the Satpura Range, Central India. This plant has erect inflorescences of 4–9 flowers that remain open for 12–18 days. During July and August, the most favourable breeding season because flowers are numerous and rainfall heavy, about 75 per cent. of the inflorescences examined contained larvae or pupae. Usually only one larva or pupa was observed in a single flower. The larvae were frequently observed to crawl over the petals of the flowers and move from one to another. Fragments of the perianths of the flowers were found in the alimentary canals of the larvae.

Thomson (R. C. M.). **Studies on the Behaviour of *Anopheles minimus*. Part I. The Selection of the Breeding Place and the Influence of Light and Shade.**—*J. Malar. Inst. India* **3** no. 2–3 pp. 265–294, 9 pls., 4 graphs, 3 figs., 23 refs. Calcutta, 1940. **Part II. The Influence of Water Movement on the Selection of the Breeding Place.**—*T. c.* pp. 295–322, 4 pls., 2 graphs, 9 figs., 8 refs. **Part III. The Influence of Water Temperature on the Choice and Suitability of the Breeding Place.**—*T. c.* pp. 323–348, 3 pls., 3 graphs, 1 fig., 11 refs.

These papers initiate a series dealing with the relation of *Anopheles minimus*, Theo., to its environment at all stages. The work was carried out at Tocklai in Upper Assam, and the first paper deals with the selection of breeding places. A method used to collect eggs in nature in a white enamel basin is described. There was no random scattering of eggs; the breeding place was determined entirely by selection by the gravid female. This finding was supported by comparative observations on *A. hyrcanus*, Pall., *A. philippinensis*, Ludl., and *A. vagus*, Dön. Laboratory observations showed that oviposition normally takes place at night, and that about 69 per cent. of eggs are laid in the first third of the night. Measurements of light, temperature and other factors possibly influencing oviposition were therefore taken 1½–2 hours after sunset. In considering breeding places, illumination at night is a more useful expression of the light factor than daylight or sunlight. A low-illumination visual photometer used to compare the light intensities in the open and under certain types of shade at different phases of the moon is described. Though *A. minimus* does not breed in water shaded by dense jungle and is effectively controlled by the shading of streams with hedges of various plants, an experimental study showed that shade in itself can play no part in control, which is entirely due to secondary effects. In laboratory and field experiments, gravid females were strongly attracted by shade, and would not oviposit in an exposed position. The necessary shade is normally provided by the thick grassy edge of a typical breeding place. Heavily shading such a place rendered it temporarily more attractive, while removal of the vegetation at the edge, with resulting exposure to light, immediately stopped breeding. In the laboratory experiments, females preferred to oviposit in the shaded half of a cage when the light intensity in the unshaded half was one-fourth of starlight, but no preference was shown when the light intensity in the unshaded half was one-tenth of starlight, although the difference in light could be appreciated by the human eye. This suggests that the mosquito's perception of light and shade at very low illuminations is not more acute than that of man. Mechanical obstruction played no part in the control effected by dense shading hedges.

The influence of water movement on the behaviour of the gravid female and larva is the subject of the second paper. It is pointed out that the current in the main body of a stream may bear no relation to the movement at the edge, where eggs and larvae are found. In the grassy edges of streams, where eggs of *A. minimus* are laid and larvae occur, the water is still. Field experiments showed that oviposition would continually take place in bare-edged, shaded side-pockets of a breeding place, not only when they communicate with the water in the stream, but also when they are completely isolated. The

pockets remained attractive only so long as the contiguous part of the stream continued to attract the females. A laboratory apparatus designed to ascertain the numbers of eggs laid in still water and water flowing at various known velocities is described. It gave a fairly uniform flow from mid-stream to within 0·75 cm. of the edges, but it was impossible to prevent a falling off between this point and the edge. Its use showed that females preferred to lay eggs in still water, and were very sensitive to flowing water, even when the velocity was as low as 1 ft. in 20 secs., though they were unaffected by a continuous surface ripple. When the velocities of the flowing water were 1 ft. in 5, 15 and 20 secs., 81·7, 77·16 and 67 per cent., respectively, of the eggs were laid in still water.

The author has never found larvae of *A. minimus* in nature where there was a perceptible flow of water. In experiments designed to show the rate of flow they could withstand, full-grown larvae were unable to resist a current velocity greater than 0·29 ft. per sec. Newly-hatched larvae were much less resistant, but could make much greater use of the surface tension forces at the point of contact between the water and the anchorage. These forces made first-instar larvae nearly as resistant as mature ones. The powers of resistance are not much greater than those of *A. hyrcanus*, a still-water breeder, and are about the same as those of *A. aconitus*, Dön., and *A. maculatus*, Theo. In investigations on the influence of light, larvae of *A. minimus* in an artificial channel with light sides and bottom were very active when no shade was available and finally settled at the edge, thigmotaxis being the deciding factor. When there was shade at the edge, they collected under it. When the central part of the water surface was shaded, there were conflicting reactions, and finally short periods on the exposed edge alternated with long periods under the shade. However, when the bottom of the channel was darkened so that there was a zone of dense shade, the preference for shade was absolute. The reactions by means of which the larvae are attracted to shade are intensified by water movement, and form the chief means of protecting the larvae from flushing. Under experimental conditions, the attraction to shade was so great that larvae left an unshaded zone of still water in favour of a shaded zone where the velocity of the current was too great for them to anchor to grass stems. In nature, once the strong reaction to shade has led the larva to a place of safety where water movement is least, thigmotactic reactions ensure that it is further protected by holding on to some convenient anchorage. The reactions of larvae of *A. maculatus* to shade were similar, but *A. hyrcanus* was attracted to shade only when the velocity of the current made anchorage precarious. Investigations of the movements of living larvae stained with dilute carmine [*cf. R.A.E.*, B **27** 79] and liberated in a stream, suggested that larval drift, as opposed to flushing, is negligible. It is suggested that the principal cause of the control of breeding effected by dense shading is the elimination of the zone of still water at the edge of the stream through the removal of the grassy edge.

In the third paper, the effect of the temperature of the water on the eggs, larvae, pupae and ovipositing females is discussed. The temperature at the surface of the water was ascertained at different times. Although during the day, running water is much colder than still water, the temperatures at night, when oviposition takes place, are approximately equal, so that water temperature cannot influence the female

in the choice of a breeding place. In laboratory experiments, females showed no marked preference when given a choice between water at 23–26°C. [73·4–78·8°F.] and water at 30°C. [86°F.], 53·4 per cent. of the eggs being deposited in the cooler water, but when they were given water at 30°C. and 35°C. [95°F.], 67·8 per cent. of the eggs were deposited in the cooler water. Females exposed to a narrow range of choice (27·8–28·5°C. [82·04–83·3°F.] opposed to 30·5–31°C. [86·9–87·8°F.]) showed no marked preference, 55 per cent. of the eggs being laid in the cooler water. The gravid female shows a general avoidance of water temperatures higher than those normally found in breeding places at night.

The thermal death points and the effects of short exposures to high temperatures were determined for eggs, young larvae, full-grown larvae and pupae. Full-grown larvae put into water at 20–25°C. [68–77°F.], which was then gradually heated, were killed by exposure for 5 minutes to 41°C. [105·8°F.] ; most were killed by exposure for 30–45 minutes to 40°C. [104°F.] or 2 hours to 39°C. [102·2°F.]. Rearing at 30°C. or previous exposure to 35°C. for 20 hours did not increase resistance to 41°C. First-instar larvae were more resistant, with a thermal death point of 42°C. [107·6°F.]. All survived exposure to 41°C. for 5 minutes. Eggs were most resistant, having a thermal death point of 43–44°C. [109·4–111·2°F.] for 5 minutes exposure. Pupae were least resistant, with a thermal death point below 41°C. The thermal death points of full-grown larvae of *A. insulaeflorum*, Sw. & Sw., *A. hyrcanus*, *A. barbirostris*, Wulp, *A. culicifacies*, Giles, and *A. vagus* were 40°C., 43–43·5°C. [110·3°F.], 43·5°C., 44°C. and 44·5–45°C.[112·1–113°F.] respectively.

There is a relation between the resistance to high temperature and the breeding habits, *A. insulaeflorum* and *A. minimus* being more susceptible than species that can breed abundantly in still water. Measurements of maximum water temperature in shallow still-water rice-fields showed that, throughout the greater part of the monsoon, the surface temperatures repeatedly reach or exceed 41°C., the thermal death point of larvae of *A. minimus*. These high temperatures may still be attained when the rice shoots (planted 9 ins. apart) are 2 ft. high, though further growth towards the end of the rainy season results in the maximum temperatures falling below this point. Temperature is an absolute limiting factor, therefore, for nearly 4 months, making such rice-fields or shallow collections of water unsuitable as breeding places for *A. minimus*. The highest temperatures recorded, 43·7 and 43·8°C. [110·66 and 110·84°F.], exceed the thermal death points of the typical rice-field breeders, *A. hyrcanus* and *A. barbirostris*, showing that temperature may occasionally be a limiting factor for these two species. Maximum temperatures in fresh-water reservoirs were normally below the thermal death point of any larvae. They are only very exceptionally used as breeding places by *A. minimus*, but temperature can play no obvious part in making them unsuitable for breeding. The maximum surface temperatures of puddles, silty borrowpits and hoof-marks were about the same as those in rice-fields. The maximum water temperature of typical running-water breeding places of *A. minimus* seldom exceeds 35°C. Under unusual conditions of drought and insolation, however, water temperature may become a limiting factor in the normal breeding place itself, several exposures to maxima of from 37·5°C. [99·5°F.] to 38°C. [100·4°F.] being incompatible with dense breeding. The

temperature rises and falls much more gradually in running than in still water. The development of eggs and pupae was followed out at constant temperatures of 16 [60·8°F.], 20, 25, 30 and 35°C. At 35°C., development is still possible for eggs, though there is high mortality among the newly-hatched larvae, but it is not possible for pupae. Successful development of both stages takes place at 16°C., the lowest mean temperature likely to be encountered in a breeding place in the coldest months of the year.

SENIOR WHITE (R.). *Anopheles stephensi* **in Calcutta.**—*J. Malar. Inst. India* **3** no. 2–3 pp. 349–361, 20 refs. Calcutta, 1940.

The literature on the occurrence and breeding places of *Anopheles stephensi*, List., in Calcutta is reviewed, and an account is given of a survey made there from April 1937 to May 1938 and from February 1939 to March 1940. It was discontinued in 1940 because *A. stephensi* became so rare that the cost of collection was excessive. In houses, trap-nets with a man and a cow as baits and an open cow-shed, 111, 3, 170 and 13 females and 2, 0, 1 and 0 males of *A. stephensi*, respectively, were taken, but the species comprised only 1·8 per cent. of the total number of Anophelines caught. It is tentatively concluded from these figures that in Calcutta, *A. stephensi* is not attracted to man in any numbers but is zoophilous [*R.A.E.*, B **27** 153], and that, after feeding, it rests elsewhere than in houses and cow-sheds. In an attempt to discover its preferred resting place, a mixture of water and citronella oil was sprayed into rat holes and cracks between roofing tiles to drive out any mosquitos that were resting there, but though mosquitos of six species were taken, *A. stephensi* was not among them. Starting in December 1937, after it was known that the species could be divided into the typical form and var. *mysorensis*, Sweet & Rao [**26** 50], as many as possible of the females caught were identified by the eggs they laid or contained. The typical form represented 71 per cent. of all the females thus identified, but a much smaller percentage of those taken during the latter part of the period of observation, apparently on account of some adverse condition affecting this form, which became very rare. Difficulty was experienced in inducing *mysorensis* females to oviposit in captivity [**26** 50], and the race of many individuals had to be determined from eggs obtained by dissecting dead females. The maxillary index of the typical form was lower than that of *mysorensis*, but the numbers of mosquitos available were too small for the difference to be significant.

Of the females caught, 193 of unknown race, 66 of the typical form and 26 of *mysorensis* were examined for malaria parasites ; all proved negative for both gut and glands.

SENIOR WHITE (R.). **Studies on the Behaviour of Adult** *A. culicifacies*. **Part III. Dissection Records.**—*J. Malar. Inst. India* **3** no. 2–3 pp. 363–382, 1 fldg map, 9 refs. Calcutta, 1940.

In view of the discovery in 1937 that *Anopheles culicifacies*, Giles, which had previously been considered a vector of malaria wherever it was found, played no part in the transmission of the disease in the Jeypore Hills though it was abundant there [*cf. R.A.E.*, B **25** 191 ; **29** 4], and the subsequent establishment of the fact that the same was the case in the Singhbhum Hills and Kutch [**26** 233], all the dissection

records made by Covell [**16** 41 ; **19** 163] and by the author and numerous other workers in subsequent published and unpublished work are re-tabulated on a geographical basis. For this purpose, India and Burma are divided into twelve regions corresponding very roughly with some of the obvious major colour patches by which Christophers & Sinton indicate varying degrees of malaria incidence on a malaria map of India [**14** 178].

The following is taken from the author's summary of the conclusions to be drawn from a study of this table : The 73,000 recorded dissections of *A. culicifacies* show that, excluding figures obtained during epidemics caused by this species, it is a very active vector in the Trans-Indus and Ceylon areas, where the sporozoite rates are 2·3 and 3·5 per cent., respectively. Between the Indus and the upper course of the Ganges, in the Burmese area (including Assam and part of Bengal), and in peninsular India south of the Godavari, the sporozoite rate is in the first place of decimals, but *A. culicifacies* is a primary vector on account of its numerical prevalence. Sporozoite rates in the north Gangetic Plain and in the Satpura Ranges are in the second place of decimals only, and it is probably not a primary vector. In the south Gangetic Plain, the Chota Nagpur Ranges, the Jeypore Hills and the eastern coastal plain north of the Godavari at the foot of these hills, it was not found infective. Its omission from specific programmes of malaria control in these last-named areas [**26** 231] has been justified by epidemiological results. The observed facts can be explained only by presuming that *A. culicifacies* consists of two as yet morphologically indistinguishable races [*cf.* **26** 178], only one of which is a vector, and the proportions of which vary from area to area. Epidemics caused by *A. culicifacies* can be explained by postulating biological conditions favouring an increase in the vector race relative to the non-vector.

Giaquinto Mira (M.). **La lotta antimalarica in A.O.I.** [Antimalarial Work in Italian East Africa.]—*Le Opere per l'Organizzazione civile in A.O.* pp. 25–53, 4 pls. Addis Ababa, 1940. (Abstr. in *Riv. Malariol.* **19** (2) fasc. 1–4 bis pp. 125–126. Rome, 1940.)

An account is given of the organisation of official work on the control of malaria in Italian East Africa up to 1939 [*cf. R.A.E.*, B **26** 67]. The disease was endemic in the low plateaux of Eritrea and in Italian Somaliland, with spleen and parasite indices of up to 100 and 51·5 per cent., respectively. Anophelines occurred commonly up to altitudes of over 6,600 ft. Fifteen species were identified, of which *Anopheles gambiae*, Giles [*cf.* **28** 142, etc.], *A. funestus*, Giles, and *A. dthali*, Patt., were dangerous vectors.

Papers noticed by Title only.

Gunn (D. L.). **The daily Rhythm of Activity of the Cockroach,** *Blatta orientalis* **L. I. Aktograph Experiments, especially in Relation to Light.**—*J. exp. Biol.* **17** no. 3 pp. 267–277, 5 figs., 23 refs. London, 1940.

Mellanby (K.). **The daily Rhythm of Activity of the Cockroach,** *Blatta orientalis* **L. II. Observations and Experiments on a natural Infestation.**—*J. exp. Biol.* **17** no. 3 pp. 278–285, 1 fig., 5 refs. London, 1940.

HAWKING (F.). **Onchocerciasis in Tanganyika Territory.**—*Ann. trop. Med. Parasit.* **34** no. 3–4 pp. 211–215, 3 refs. Liverpool, 1940.

Previous records of the occurrence of onchocercosis and *Simulium* spp. in south-western Tanganyika Territory are reviewed from the literature and private communications, and an account is given of a survey made there in May 1939 at the end of the rainy season. Among the 1,087 natives examined, only 8 showed microfilariae of *Onchocerca volvulus*. Of these, 4 were at Njombe and 3 at Tukuyu. In only one case was a definite nodule present. The altitude and rainfall of many of the places involved in the investigation are given and also further descriptions of some of them. The only station at which *Simulium* spp. were taken was Njombe. Here, the flies were numerous and voracious at the foot of a waterfall 200–300 ft. high, but no larvae were found on the stones or weeds, although the water must be exceptionally aerated. Natives rarely visit the foot of the fall. At its head, only occasional adults were noted, but larvae and pupae were found in great numbers attached to coarse green plants submerged between the rocks. The flow at this point is rapid, but the surface of the water is smooth and unbroken and there is no reason to suppose exceptional aeration. E. G. Gibbins, to whom specimens were sent, reported that 81 of the adults taken while biting were *S. damnosum*, Theo., and 5 *S. neavei*, Roub., the pupae included *S. damnosum*, *S. medusaeformis*, Pom., and *S. lepidum*, De Meillon, and the larvae, many of which were too young to identify, included *S. damnosum*. It was not possible to search for *Simulium* at Tukuyu, where there are, however, streams that would appear to be suitable breeding places.

MESNARD (J.) & TOUMANOFF (C.). **Agent infectieux du genre *Rickettsia*, mis en évidence chez une tique (*Haemaphysalis bispinosa* Neumann) du cerf de la Cochinchine.**—*C. R. Acad. Sci.* **210** no. 10 pp. 378–380. Paris, 1940.

For some ten years, cases of tropical typhus have been observed among Europeans and natives in Cochin China. Most of the Europeans had been in forest areas and were conscious of having received tick bites, but none of the ticks was preserved and no information is so far available on the vectors or reservoir of the disease. In the course of attempts to isolate the causal organism from ticks found on various wild animals, 21 freshly engorged examples of *Haemaphysalis bispinosa*, Neum., taken from a sambur (*Rusa unicolor*) killed in the forest during August 1939 were divided into lots of three, and their body contents were inoculated into seven guineapigs. An infective agent of the genus *Rickettsia* was isolated from one of these guineapigs and has been maintained by serial passage in others for six months. The guineapigs show a characteristic temperature curve and sometimes a scrotal reaction. The infection may also be inapparent.

SUGIMOTO (M.). **Studies on the Formosan Mites. On the Feather Mites, Analgesidae Canestr. 1892.** [*In Japanese.*]—*Bull. Sch. Agric. For., Taihoku Imp. Univ.* no. 1 pp. 40–58, 5 pls. Taihoku, 1940. (With a Summary in English.)

A general account is given of the morphology, biology and taxonomy of Analgesid mites, together with descriptions and host records of the Formosan species. They include *Pterolichus columbae*, sp. n., on domestic pigeon and another new species on a wild bird.

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De Meillon (B.). **Notes on Siphonaptera from Southern Africa.**—*Proc. R. ent. Soc. Lond.* (B) **9** pt. 9 pp. 145–153, 17 figs. London, 1940.

The new genus *Epirimia* is erected for *Hypsophthalmus aganippes*, Roths. (the type) and *H. granti*, Roths., and a number of new species and subspecies of other genera are described. These include *Chiastopsylla couchae* from a nest of *Mastomys coucha* and *Xenopsylla davisi* from nests of *Gerbillus paeba* and burrows of *Tatera* (*Taterona*) *afra*, all in Cape Province.

Müller (K. H.). **Zur Biologie der Taubenzecke** *Argas columbarum*. [The Biology of the Pigeon Tick, *A. reflexus*.]—Inaug. Dissert. Fried.-Wilh. Univ.Berlin 40 pp., 9 figs., 5 pp. refs. Berlin, 1939. [Recd. 1941.]

An account is given of the morphology of all stages and the internal anatomy of the pigeon tick, *Argas reflexus*, F., and of the results of a study of its biology carried out in Berlin in 1935–37, the salient features of which have already been noticed [*R.A.E.*, B **28** 253]. The author uses the name *A. columbarum*, Shaw, for this tick, but gives no reference to a paper by Shaw in which it was described, either in a brief discussion of its synonymy or in his bibliography.

[Kurchatov (V. I.).] **Курчатов (В. И.). Prophylaxis of Piroplasmosis and anti-Tick Measures in the cold Season of the Year.** [*In Russian.*]—*Sovetsk. Vet.* **17** no. 1 pp. 30–32. Moscow, 1940.

In the Russian Union, the usual period during which domestic animals become infected with piroplasmosis is spring and summer, and at this period various control measures, including work against ticks, are carried out. It has been observed, however, that some ticks that transmit various forms of the disease are present on the animals throughout the cold season as well, especially in the southern part of the Union, and cases of piroplasmosis of cattle and horses in Azerbaijan and of horses and sheep in the Crimea have occurred in late autumn or winter. A list is, therefore, given of ticks that infest domestic animals in the cold season, arranged under the stages in which they attack them, and showing those that transmit various forms of piroplasmosis. Recommendations, based on the literature, are given for controlling the ticks on domestic animals and in their quarters during the cold season.

[Kurchatov (V. I.).] **Курчатов (В. И.). A Survey of the Fauna of bloodsucking Ticks of the Family Ixodidae in the Crimea. (Abstract.)** [*In Russian.*]—*Sovetsk. Vet.* **17** no. 1 p. 32. Moscow, 1940.

In connection with investigations on piroplasmosis of domestic animals, a survey was made of the species, distribution and seasonal occurrence of Ixodids in the Crimea. Those found were : *Hyalomma marginatum*, Koch, *H. volgense*, P. Schulze & Schlottke, *Dermacentor silvarum*, Olen., and *Haemaphysalis cinnabarina punctata*, C. & F., which were the most common and occurred in all areas ; *Rhipicephalus bursa*, C. & F., which was also widely distributed, especially in the foothill zone, but was rare in the north and in the mountains ; *R. sanguineus*, Latr., and *Boophilus calcaratus*, Bir., which were most

abundant in the forest-steppe areas in river valleys and along the southern coast ; *Haemaphysalis inermis*, Bir., *D. marginatus*, Sulz., and *Ixodes ricinus*, L., which were mainly present in the mountain-forest zone ; *Haemaphysalis otophila*, P. Schulze, and *H. sulcata*, C. & F., which occurred in the steppe and forest-steppe areas ; and *H. concinna*, Koch, *H. numidiana*, Neum., *H. caucasica*, Olen., and *R. sanguineus rossicus*, Yak. & Kohl-Yak., which were rare.

Records of the seasonal occurrence of the adults on domestic animals showed that *H. marginatum* was present from February to November and most abundant in May and June ; *I. ricinus* was found from March to December ; *B. calcaratus* was abundant in March–April and July–September ; *R. bursa* occurred in May–September and was numerous in May and June ; and *H. volgense* was present from December to May. The greatest numbers of *H. cinnabarina punctata*, *H. otophila*, *D. silvarum* and *D. marginatus* were observed in autumn and spring, and the last-named could not be found in summer. The adults of all the ticks attacked cattle, while those of 11, 9, 7, 5, 2 and 1 species attacked sheep, horses, dogs, goats, pigs and donkeys, respectively. The larvae and nymphs of *B. calcaratus*, *H. volgense*, *R. sanguineus* and *R. bursa* also chiefly attacked domestic animals, but those of *D. silvarum*, *I. ricinus* and *H. cinnabarina punctata* occurred mainly on small mammals and reptiles, and the last-named also on birds.

The distribution of the ticks indicate that various forms of piroplasmosis occur in horses and cattle throughout the Crimea, and in sheep in the southern two-thirds. Only the mountain-meadow zone is free from disease. Control measures against ticks on cattle and horses should be carried out from early spring till late autumn, and against those on sheep from May to September.

[Markov (A. A.) & Kurchatov (V. I.).] **Марков (А. А.) и Курчатов (В. И.). Investigations on the Survival of** *Babesiella ovis* **in Vector Ticks.** (**Abstract.**) [*In Russian.*]—*Sovetsk. Vet.* **17** no. 1 p. 33. Moscow, 1940.

In experiments in 1937–39, the progeny of a female of *Rhipicephalus bursa*, C. & F., that had fed on a ram infected with piroplasmosis caused by *Piroplasma* (*Babesiella*) *ovis* were reared for three generations on animals immune from the disease (a horse, rabbits and a bullock). Batches of ticks taken from the second and third generations were fed on sheep, and these developed a severe form of piroplasmosis, one of them dying as a result of infection by ticks of the third generation. Since *R. bursa* has only one generation a year, these experiments show that the removal of sheep for three years will not render pastures free from infection, as the ticks will still remain infective though they may feed on immune hosts for a considerable period.

[Markov (A. A.), Kurchatov (V. I.) & Dzasokhov (G. S.).] **Марков (А. А.), Курчатов (В. И.) и Дзасохов (Г. С.). The Part Played by the Tick** *Rhipicephalus bursa* **in the Spread of Equine Nuttaliasis.** (**Abstract.**) [*In Russian.*]—*Sovetsk. Vet.* **17** no. 1 p. 33. Moscow, 1940.

Evidence was obtained from field observations in the Crimea that, in addition to *Hyalomma marginatum*, Koch, *Rhipicephalus bursa*, C. & F., may also be a vector of the form of equine piroplasmosis caused by

Nuttallia [*equi*]. To verify this, adults of *R. bursa* taken, before they had engorged, on cows in a locality in the Crimea in which the disease occurred in horses were placed on a healthy foal from a part of Russia free from the disease. The foal became definitely infected.

[Abramov (I. V.).] **Абрамов (И. В.). Duration of Infection in Piroplasmosis. (Abstract.)** [*In Russian.*]—*Sovetsk. Vet.* **17** no. 1 pp. 33–34. Moscow, 1940.

Observations over a number of years have shown that *Piroplasma trautmanni, P. bigeminum* and *P. caballi* can survive in the blood of pigs, cattle and horses, respectively, for 8, 15 and 41 months, while *Nuttallia equi* has been found to be present in the blood of a horse infected 5½ years previously. The organisms causing various forms of piroplasmosis of sheep could not be observed in the blood of the animals 20–21 months after infection, and when examples of *Rhipicephalus bursa*, C. & F., were placed on a ram that had been infected 26 months previously by examples of the same strain of *R. bursa*, the animal contracted the disease and died. This indicates that sheep that recover from the disease may become reinfected in 20–26 months.

[Markov (A. A.), Kurchatov (V. I.) & Abusalimov (N. S.).] **Марков (А. А.), Курчатов (В. И.) и Абусалимов (Н. С.). Canine Piroplasmosis in Azerbaijan. (Abstract.)** [*In Russian.*]—*Sovetsk. Vet.* **17** no. 1 p. 34. Moscow, 1940.

Cases of canine piroplasmosis occurred in several localities in Azerbaijan in May and June of 1938 and 1939, and various forms of *Piroplasma canis* were observed in smears of the peripheral blood of infected dogs. All ticks collected from both infected and healthy dogs were *Rhipicephalus sanguineus*, Latr., which was particularly abundant in late May and early June, when some dogs harboured several thousand each. The association of the seasonal prevalence of *R. sanguineus* with that of the disease indicates that this tick is the vector in Azerbaijan.

[Kurchatov (V. I.) & Sokolov (B. D.).] **Курчатов (В. И.) и Соколов (Б. Д.). The Epizootology of Crimean Mountain Pastures ("Yaïla") in the Light of Prophilaxis for Piroplasmosis. (Abstract.)** [*In Russian.*]—*Sovetsk. Vet.* **17** no. 1 p. 35. Moscow, 1940.

Investigations were carried out in the Crimea on the vectors of piroplasmosis of sheep, horses and cattle grazing on mountain pastures, consisting of meadows and steppes at altitudes of some 3,000–4,500 ft., with special reference to the system of pasture rotation.

Ticks were collected from the animals at regular intervals, smears were taken of the blood from diseased animals, and attempts were made to relate the dates when the animals were driven to the pastures with the incidence of the diseases. Ticks were abundant on the animals and outbreaks of piroplasmosis almost always occurred in them shortly after they had arrived from the valleys, the infestation and infection having evidently been contracted in the low-lying winter pastures or on the way to the mountains. The cattle in the valleys were heavily infested with *Boophilus calcaratus*, Bir., and the horses with *Hyalomma marginatum*, Koch, *Dermacentor silvarum*, Olen., and *D. marginatus*, Sulz. Though these ticks were also found in the

mountain pastures as well as *Rhipicephalus bursa*, C. & F., *Haemaphysalis cinnabarina punctata*, C. & F., and *Ixodes ricinus*, L., cattle and horses that remained in them for any length of time were seldom infested. Outbreaks of piroplasmosis in sheep, however, occur in some years, especially in the steppe pastures in the eastern district, where *R. bursa* is more abundant than in the west.

On the basis of these observations, the authors suggest that sheep should be driven to the mountain pastures not later than the first ten days of May, before *R. bursa* appears in the valleys. Animals that are particularly susceptible to piroplasmosis (especially those from other parts of the Russian Union) should be kept under observation from the time that *R. bursa* appears in the mountain pastures, which it does at the end of May. To prevent infection, cattle and horses should not be allowed to descend to the slopes of the mountains, which are covered with forest and infested with ticks.

[Markov (A. A.) & Kurchatov (V. I.).] **Марков (А. А.) и Курчатов (В. И.). Calendar of basic Measures with Reference to Diseases of domestic Animals caused by Haemosporidia (Piroplasmosis).** [*In Russian.*]—*Sovetsk. Vet.* **17** no. 2–3 pp. 21–25. Moscow, 1940.

A schedule is given of the measures, including those against ticks, required at different seasons of the year and in different parts of the Russian Union for the control of various forms of piroplasmosis in horses, cattle and sheep, and of anaplasmosis of cattle.

[Kurchatov (V. I.).] **Курчатов (В. И.). The Outlines of the Study of Vector Ticks in Accordance with the Problems of the Control of Piroplasmosis.** [*In Russian.*]—*Sovetsk. Vet.* **17** no. 2–3 pp. 28–31. Moscow, 1940.

It has been suggested that the various forms of piroplasmosis that occur in domestic animals in the Russian Union could be controlled by measures that would include those directed against ticks in general. The author, therefore, points out that about 30 species occur on domestic animals in the Russian Union and that different species transmit different forms of the disease. He gives a review of the literature to show how the successful control of a given species depends on a knowledge of its individual bionomics and ecology, and outlines the methods of research required to obtain this knowledge.

[Shmulevich (A. I.), Kobuilyakov (D. G.) & Lebedev (—).] **Шмулевич (А. И.), Кобыляков (Д. Г.) и Лебедев (—). A Three Years' Experiment in the Application of Solutions of Sodium Arsenite in the Control of the Tick** *Dermacentor marginatus*. **(Abstract.)** [*In Russian.*]—*Sovetsk. Vet.* **17** no. 2–3 p. 34. Moscow, 1940.

Though *Piroplasma caballi* is common in horses in the district of Kadom, in the south-east of the Province of Moscow, *Dermacentor marginatus*, Sulz., was the only vector found there. It was, however, very abundant on horses at pasture. In investigations on the control of the tick, the horses were rubbed down every five days from early May until 20th June 1937 with a solution of sodium arsenite in water

containing 0·24 per cent. As_2O_3, and as a result of the subsequent general application of this treatment, a reduction of 90 per cent. in the numbers of infected horses took place between 1937 and 1939.

COBBETT (N. G.). **An effective Treatment for the Control of the Sheep Head Grub,** *Oestrus ovis,* **in Areas where the Winters are cold.**—*J. Amer. vet. med. Ass.* **97** no. 765, pp. 565–570, 3 figs., 6 refs. Chicago, Ill., 1940. **A Method of large-scale Treatment of Sheep for the Destruction of Head Grubs** (=*Oestrus ovis*).—*T. c.* pp. 571–575, 6 figs.

Previous work on the treatment of *Oestrus ovis,* L., in sheep is reviewed in the first paper, and an account given of biological investigations by the author in New Mexico during the years 1933–37 [*R.A.E.*, B **24** 84], which led to the conclusion that control could be obtained there and in other areas with cold winters by destroying the small larvae in the nasal passages during late autumn and winter, since these are practically the only stage of the fly present at the time. In numerous experiments, larvicides in many forms were introduced into the nasal passages in a variety of ways. The best results were obtained with 3 per cent. solutions of saponified cresol [**27** 145; **28** 101, etc.]. The technique to be adopted was determined by injecting a tissue-staining solution into the nostrils of the sheep by various methods with the head in various positions. The nasal mucous membrane was most completely stained in heads held with the dorsal surface down and the muzzle slightly elevated and receiving the solution in a small stream backed by a pressure of 35–45 lb. per sq. inch. In a number of experiments on sheep shortly to be slaughtered, the injection of 1 fl. oz. of solution into each nostril killed about 90 per cent. of the larvae [**28** 101], and two such treatments at intervals of 5 days killed about 98 per cent. The treatment caused temporary irritation of the mucous membrane involved, giving rise to spasmodic coughing and sneezing and a flow of mucus from the nostrils. No injury resulted when the treatment was administered quickly and the animals released promptly to prevent possible strangulation.

The second paper contains a description of a practical method of applying the solution devised during treatment of thousands of sheep in New Mexico. The equipment consists of a restraint table and an air pressure treating apparatus. The table has a V-shaped trough of oak board with wooden blocks nailed into one end to form a head rest. It is fixed on a stand in a manner that allows it to be tipped to one side when a sheep has been treated, so that the animal alights on its feet. The air pressure apparatus consisted of a solution tank, an auxiliary air storage tank, a motor-driven air pump attachment for compressing air in the auxiliary tank, a lead-off and a nozzle for injecting the solution into the nostrils of the sheep. The restraint table forms one side of a catch pen, so that the tilting of the trough causes the sheep to land outside the pen. During large-scale operations, two tables were placed end to end. An operator and five helpers worked at each table. One helper caught a sheep in the pen and placed it on its back, two swung it by the legs into the trough and two held its hind legs and fore legs and head, respectively. The operator forced the nose downwards between the blocks of the rest and held the nostrils open with the left hand, and operated the nozzle with the right. The point of the nozzle was inserted 1–2 ins. into each nostril in turn in a downward and outward direction. When two

tables were used continuously, it was possible to treat 700 sheep in an hour. About 90,000 range sheep have been satisfactorily treated in New Mexico in the years 1936–39, principally during November and December.

FALLIS (A. M.). **Studies on *Oestrus ovis* L.**—*Canad. J. Res.* (D) **18** no. 12 pp. 442–446, 2 pls., 5 refs. Ottawa, 1940.

Of 698 sheep and lambs, one year old and under, examined at an abattoir where they had been received from scattered points in Ontario and western Canada, 50 per cent. were infested with larvae of *Oestrus ovis*, L. The incidence was higher if only the older animals were counted, over 90 per cent. of those examined from August to May being infested. From larvae that pupated in sand in the laboratory, twelve adults were obtained between 2nd May and 24th September; eight of these, kept at room temperature, lived for an average of 16 days, one surviving for 28 days and two for 10 days only. If adults remain active for two weeks in nature, a relatively small population might produce a high infestation. The smallest larvae were found on 2nd September and 25th November, and the largest on 16th March. The characteristics of the three larval instars are given. Over 60 per cent. of the infested animals were harbouring larvae in two or three instars.

The rate of development of the larvae varies considerably. Spring lambs in Ontario are probably seldom exposed to the parasite before the beginning of May. A larva, which later gave rise to an adult, was recovered from the sinus of a lamb examined on 29th July. It thus appears that the life-cycle may be completed in about 3 months in early summer [*cf. R.A.E.*, B **21** 155]. On the other hand, first-instar larvae were found in lambs examined throughout the autumn and winter months when the temperature was such as to preclude the possibility of recent infestation. The great majority of the larvae found between September and February were in the first instar and few or none in the third. Many of the small larvae, most of which are found in the nares, are probably ejected by sneezing, whereas the larger larvae remain, as they are found only in the sinuses. If the sinuses only were examined, many first-instar larvae would be overlooked. Two experiments in which lambs moved from outdoors in midwinter to a heated building were compared with control lambs kept outside showed that an increase in the temperature of the host's environment does not necessarily cause an increase in the rate of growth of the larvae, which appears, however, to vary with the time of year. It also appears from these studies that there may be two generations annually in Canada. Pupae were obtained by leaving mature larvae in dry sand at room temperature. The first and last larvae to pupate were taken on 5th April and 12th August, respectively. The pupal periods of 12 individuals varied from 19 to 34 days, with an average of 29 days.

HURST (H.). **Permeability of Insect Cuticle.**—*Nature* **145** no. 3673 pp. 462–463, 5 refs. London, 1940.

WIGGLESWORTH (V. B.). **Permeability of Insect Cuticle.**—*Op. cit.* **147** no. 3717 p. 116, 1 ref. 1941.

It is stated in the first paper that workers who have attempted to correlate the toxicity of an insecticide with its chemical and physical

properties have failed to attach sufficient physiological significance to the action of the carriers in relation to the toxic principle under investigation. A study of the toxicities to *Cimex lectularius*, L., of constituents of heavy naphtha [a coal-tar distillate used for its control (*R.A.E.*, B **25** 177; **27** 62; **28** 72)] showed that the toxicity of unsaturated compounds may be materially increased by the addition of non-toxic mixtures of paraffins and cycloparaffins. The assumption that the unsaturated compound was assisted through the cuticle by the more apolar substances present in heavy naphtha led to an investigation of the general physiology and permeability of the insect cuticle. The results show that feebly dissociating compounds of high dielectric constant penetrate the cuticle much more readily in the presence of relatively apolar substances of low dielectric constant, the main region of induced penetration being at the cuticle-haemolymph interface. This applies to both contact and fumigant action. An experiment to illustrate this showed that when a larva of *Calliphora erythrocephala*, Mg., is immersed in ethyl alcohol, penetration through the cuticle and tracheal system takes place very slowly and the insect remains active for at least an hour. The effect of paraffins of the kerosene type is even less pronounced. With a mixture of ethyl alcohol and paraffins, penetration of the alcohol is so rapid that the larva dies within a few seconds, swells perceptibly and bursts within 4–6 minutes. Passage of water from the larva causes a peculiar swirling effect in the region of the cuticle and results in the paraffins being thrown out of solution in the immediate vicinity of the insect and the two components becoming partly separated throughout the volume of the liquid. Mechanical blocking of the spiracles does not materially affect the nature of the results.

The mechanism of penetration has been studied for the cuticles of several species of insects, and an account of this work, together with various insecticidal applications, is to be published. The present work has shown that the thin outer lipoid layer of the insect cuticle is relatively impermeable to polar compounds, but that the inner chitinous layer is relatively permeable to both polar and apolar compounds. The permeability of the lipoid layer to polar compounds is greatly increased by the presence of apolar substances. Thus, when a mixture of ethyl alcohol and paraffins is applied to the cuticle, the polar compound will penetrate the outer lipoid layer and then diffuse into the insect through the chitinous layer, the rate and extent of this diffusion being more pronounced than the diffusion of water in the reverse direction. The *Calliphora* larvae burst before equilibrium was attained. With any particular mixture, the diffusion is governed by mutual solubilities and the pathological changes occurring in the various tissues. The permeability of the cuticle as a whole to polar compounds is increased in both directions by the presence of apolar substances. This increase is more pronounced in the direction from lipoid to chitin layer than in the opposite direction. The relation between polarity and induced penetration of one or more substances has been worked out for a large number of compounds and applies generally to polar substances of feebly dissociating properties. Induced penetration appears to be negligible for such strongly dissociating compounds as neutral salts and mineral acids. The results obtained are in agreement with the work of Morozov [A **24** 587] and Alexandrov on the permeability of the insect cuticle to various substances acting singly, while Fulton and Howard [A **26** 739] have shown

that the toxicity of derris inside the insect may vary with the nature of the oil carrier used.

In the second paper, the author records experiments confirming the view that apolar substances of low dielectric constant greatly increase the permeability of the lipoid layer. When a flea or louse is immersed in oil, minute droplets of water appear all over the cuticle within a few minutes if xylol is used or within half an hour or so if medicinal paraffin or olive oil is used. They are often most marked on the hardest parts. Presumably, polar substances of some kind crowd into the oil-water interface as the lipoid layer dissolves, and thus draw out the water droplets. If such an insect is immersed in a mixture of ethyl alcohol and kerosene, the droplets swell up and separate with such violence that the insect seems to be effervescing. This is because, in the presence of traces of water, the alcohol separates from the paraffin. A list is given of other mixtures in which the same phenomenon is seen. These observations stress the importance of the partition coefficient of a substance between oil and water in determining the rate at which it will leave the oily base of a contact insecticide and enter the tissues of an insect.

PARKER (B. M.) & CAMPBELL (F. L.). **Relative Susceptibility of the Ootheca and Adult Female of the German Cockroach to Liquid Household Insecticides.**—*J. econ. Ent.* **33** no. 4 pp. 610–614, 5 refs. Menasha, Wis., 1940.

An investigation was made to determine whether the ootheca (here used to refer to the egg capsule and the eggs within it) of *Blattella germanica*, L., which is carried by the female until the eggs hatch, can survive an application of spray sufficient to kill the females. As the question is complicated by the fact that certain sprays cause the females to drop their oothecae prematurely [*R.A.E.*, B **27** 18], a study was made of the hatching of manually detached oothecae and those dropped as a result of insecticidal action. The period between the appearance of the ootheca and normal hatching under the conditions described by Woodbury [**27** 17] was 17–28 days at 76–83°F. Oothecae removed from the females by hand and kept dry shrivelled in 2–4 days but hatched nevertheless, producing undersized but otherwise apparently normal nymphs. The percentage hatch among them was somewhat lower than that among attached ones, and partial hatching was more prevalent. One ootheca partly hatched 24 days after it had been detached. The controls completed hatching 28 days after the beginning of the experiment. Keeping the detached oothecae in a saturated atmosphere did not prevent shrivelling. When they were kept in contact with water, however, they tended to swell. The percentage hatch of wet oothecae was not so great as that of dry ones, and partial hatching did not occur among them. As it appeared from these observations that the attached ootheca is in physiological equilibrium with the body fluids of the female, it seemed that the best hatch of detached oothecae might be obtained by placing them in contact with normal saline. Under such conditions, some oothecae removed from the female within 24 hours of their extrusion hatched, and in an experiment with oothecae of unknown ages, a better percentage of hatch was obtained than with the dry ones, though it did not equal that of the attached controls.

Pairing occurred about 6 days after the last moult of the female, and the first oothecae appeared about 4 days after pairing. A female may form 2–7 oothecae, and one mating appears to be sufficient to fertilise all the eggs. When an ootheca was removed before it was a week old, about 2 weeks elapsed before the next one appeared. The normal period between the hatching of one and the appearance of the next is 7–9 days.

In the tests of the effect of liquid insecticides, extracts of pyrethrum (pyrethrins), normal butyl carbitol thiocyanate, cresylic acid and rotenone, all in highly refined kerosene, were compared with the Official Test Insecticide (pyrethrins). All were applied by a settling mist method [**27** 18]. At the concentrations used, the effective sprays were those containing pyrethrins or the thiocyanate. Both exerted a marked paralytic effect on the females, but while the pyrethrins caused most of them to drop their oothecae, the thiocyanate did not. Presumably, the pyrethrins cause muscular contractions that are not induced by the thiocyanate. The loss of the ootheca does not necessarily result in the death of the female, but at the higher concentrations and dosages used, the kill of females by pyrethrins was markedly higher than that of oothecae. The pyrethrins did, however, exert some direct insecticidal action on the oothecae. The thiocyanate at a very high concentration was the most effective spray against the adults and was as effective as the pyrethrins against the oothecae. An ootheca attached to a dead female probably has little more chance of surviving than a detached one. Cresylic acid used at the same concentration as the thiocyanate appeared to have a very slight effect on the adults, but little or none on the oothecae. Rotenone was likewise of doubtful value at the concentrations used, which were comparable with those of the pyrethrins [*cf.* **27** 18]. Neither cresylic acid nor rotenone caused females to drop their oothecae. Kerosene alone had no demonstrable effect.

Brody (A. L.) & Knipling (E. F.). **Methods of destroying Blowfly Larvae and Pupae in Carcasses and in Soil.**—*J. econ. Ent.* **33** no. 4 pp. 662–665, 1 ref. Menasha, Wis., 1940.

Cochliomyia hominivorax, Coq. (*americana*, Cush. & Patt.) apparently breeds only in living animals, but large numbers of the larvae may be present in carcasses of animals killed by them. Nearly mature larvae in the wound tend to migrate into the soil soon after the animal dies, but some of the immature ones continue to develop in the carcass. The destruction of larvae and pupae in the carcass and the soil near it is therefore of possible practical value as a means of preventing an increase in the population of *C. hominivorax* in nature. Tests were carried out in southern Georgia in 1936–38 to determine the most effective means of destroying larvae of this species and other blowflies in carcasses and in the soil. The methods tested were chemical treatment, burning of the carcasses and soil, and pounding of the soil.

Preliminary tests with chemicals were carried out on grass plots 1 yard square containing artificially implanted larvae of *C. hominivorax*. More significant field tests were carried out by placing carcasses of infested animals on plots 4 sq. yds. in area covered by different types of flora. Before treatment, these carcasses became infested with large numbers of blowflies of other species. All test plots were covered

with cages to trap the emerging flies. In the preliminary tests, 1 oz. sodium cyanide in ½–2 U.S. gals. water gave 100 per cent. mortality and ½ oz. in 1–2 U.S. gals. water gave 98 per cent. In tests on larger plots, ½ and 1 oz. in 2 U.S. gals. water per sq. yd. gave complete kill of larvae in carcasses and in the soil on which the carcasses had lain, while ¼ oz. in 2 U.S. gals. gave 98 per cent. kill of larvae and pupae in the soil. The results of preliminary tests with carbon bisulphide were inconsistent. In field tests, ¼ U.S. pint of an emulsion containing equal parts carbon bisulphide and neutral sulphonated castor oil in 2 U.S. gals. water per sq. yd. killed all larvae and pupae of *C. hominivorax* in the soil.

Pounding the soil seemed to be effective on improved pasture sod, but relatively ineffective on rough woodland pastures. Tests with a blow-torch using petrol or kerosene showed that burning carcasses and heating the soil on which they had lain may prevent the emergence of *C. hominivorax* but not of other blowflies, and this method was costly and depended very much for its success on the competence of the operator. Top burning, in which a fire sufficient to burn it completely is built over the carcass and then spread evenly over the test area, gave better control than the trench method, in which a trench was dug within the confines of the test plot and the carcass burnt on wood piled within it, but less so than a combination of the two methods, in which the carcass was burnt mainly by the trench method and the fire was spread over the carcass and the rest of the test plot for an area extending at least 3 ft. from the carcass in all directions.

BUSHLAND (R. C.). **The Toxicity of Phenothiazine and certain related Compounds to young Screwworms.**—*J. econ. Ent.* **33** no. 4 pp. 666–669, 1 ref. Menasha, Wis., 1940.

BUSHLAND (R. C.). **The Toxicity of some Organic Compounds to young Screwworms.**—*T. c.* pp. 669–676, 4 refs.

The toxicity of over 800 organic compounds to young larvae of *Cochliomyia hominivorax*, Coq. (*americana*, Cush. & Patt.) was tested by placing newly hatched larvae on a mixture of the substance under examination with a nutritional medium consisting of ground lean beef, bovine blood, water and sufficient formaldehyde to retard putrefaction. The method proved very satisfactory for selecting larvicides for further study in field tests. The various substances were first tested at a concentration in the nutritional medium of 0·67 per cent., and if they gave complete kill, they were tested successively at 0·33, 0·17, 0·10, 0·08, 0·05, 0·03, 0·01 and 0·005 per cent. until some larvae survived for three days. The minimum lethal concentration of a substance is expressed as the range between the highest concentration at which some larvae survived for 3 days and the lowest at which all the larvae died. The results obtained with phenothiazine [thiodiphenylamine] and 21 related compounds are given in the first paper. The medium lethal concentration of phenothiazine was 0·03–0·05 per cent. Four other substances were equally effective and two, acridine and phenazine, were more so. Five were non-toxic at 0·67 per cent. The relationship between molecular structure and toxicity to larvae of *C. hominivorax* is briefly discussed. It appears that any alteration of the molecule in these compounds may influence toxicity.

In the second paper, the results obtained with 551 compounds are given. Of these, 284 showed little or no toxicity at 0·67 per cent.,

190 killed all larvae at 0·10–0·67 per cent. and 77 were lethal at a concentration of 0·10 per cent. or less. Of these, 10 were less toxic than rotenone, 25 were equal in toxicity to rotenone (minimum lethal concentration 0·05–0·08 per cent.), 31 were equal in toxicity to phenothiazine (0·03–0·05 per cent.) and 11 were more toxic (0·01–0·03 per cent.). These 11 compounds were cinchonine, m-dinitrobenzene, 2,6-dinitro-4-chlorophenol, 3,5-dinitro-o-cresol, 2,4-dinitro-6-cyclohexylphenol, methylphenylnitrosoamine, o-nitroanisole, p-nitroanisole, p-nitrobenzonitrile, p-nitrophenetole and p-nitrophenylacetonitrile. These studies revealed no basis from which the toxicity of a prospective larvicide can be definitely predicted, but some groups showed more promise than others.

Parish (H. E.). **Effects of Phenothiazine on Chicken Lice.**—*J. econ. Ent.* **33** no. 4 p. 700. Menasha, Wis., 1940.

A cock, rather heavily infested with lice, including *Gallipeurus* (*Lipeurus*) *heterographus*, Nitzsch, *Eomenacanthus stramineus*, Nitzsch, *Menopon gallinae*, L., and *Goniocotes gallinae*, Retz. (*hologaster*, Nitzsch), was found to be free from living lice two days after it had been dusted with phenothiazine [thiodiphenylamine]. In further tests, four hens that had very heavy infestations of *E. stramineus*, moderate infestations of *Gallipeurus heterographus* and light infestations of *Goniocotes gallinae*, including numerous nits, were treated, and two heavily infested, untreated hens and two similar cocks were placed in the pen with them two days later. No lice were found on the dusted hens 7 days after treatment and only four individuals of *E. stramineus* 21 days later, while the untreated fowls remained heavily infested. White fowls are temporarily discoloured by the use of phenothiazine. No apparent ill effect was caused by feeding ten laying hens on a 5 per cent. concentration in commercial laying mash for 30 days.

Trembley (H. L.) & Bishopp (F. C.). **Distribution and Hosts of some Fleas of Economic Importance.**—*J. econ. Ent.* **33** no. 4 pp. 701–703. Menasha, Wis., 1940.

Records of the hosts and distribution of *Ctenocephalides felis*, Bch., *C. canis*, Curt., *Pulex irritans*, L., *Xenopsylla cheopis*, Roths., and *Echidnophaga gallinacea*, Westw., in the United States are given from observations made by the Division of Insects affecting Man and Animals of the Bureau of Entomology and Plant Quarantine and from the literature. In the case of hosts on which the fleas were observed by members of the division, the number of times that each species was taken on each host is shown. Brief notes are included on the importance and seasonal prevalence of the various fleas.

Smith (R. O. A.), Halder (K. C.) & Ahmed (I.). **Further Investigations on the Transmission of Kala-azar. Part I. The Maintenance of Sandflies** *P. argentipes* **on Nutriment other than Blood.**—*Indian J. med. Res.* **28** no. 2 pp. 575–579, 8 refs. Calcutta, 1940. **Part II. The Phenomenon of the "Blocked" Sandfly.**—*T.c.* pp. 581–584, 1 ref. **Part III. The Transmission of Kala-azar by the Bite of the Sandfly** *P. argentipes*.—*T.c.* pp. 585–591, 6 refs.

Most of the information contained in the first two parts of this paper on experiments designed to confirm the view that *Phlebotomus*

argentipes, Ann. & Brun., is the vector of visceral leishmaniasis in India has already been noticed [*R.A.E.*, B **28** 155]. It is stated in the first part that it has been estimated that about half of the sandflies that take a first blood meal on a kala-azar patient and are then fed on raisins are available at the end of 10 days for delivering infective bites, whereas it had previously been calculated that only about 15 per cent. of those maintained on successive blood meals survived to the tenth day [*cf.* **24** 308]. In the second part, it is recorded that 58 out of 225 sandflies known to be positive were " blocked," and 49 of these were heavily infected with flagellates.

The third part deals with experiments in which ten mice, which are considered to be relatively resistant to infection with *Leishmania*, and five hamsters [*Cricetulus*] were exposed to the bites of sandflies maintained for ten days on raisins after a preliminary feed on a kala-azar patient. Two of the mice died soon after the beginning of the experiment. All the hamsters and two of the mice became infected, though the latter had received no great number of bites from sandflies known to be positive. It is thought that some at least of the mice that had larger numbers of known positive feeds would have been found infected had they survived longer or had cultures of spleen and liver tissue been possible. The period between the infective feed and the termination of an experiment with a positive result ranged from 6 weeks in the case of a hamster to a little more than 7 months in the case of a mouse. The two mice that were found to be infected had, so far as is known, no bites from " blocked " sandflies, but one of the hamsters that became infected was bitten by " blocked " sandflies only. It is not known whether the success of these transmission experiments is attributable to an increase in the virulence of the parasites [*cf.* **19** 175] or in the doses of flagellates inoculated. The two hypotheses are discussed. An observation by K. V. Krishnan that the action of fresh normal or kala-azar serum on flagellates of *Leishmania donovani* results in their destruction by lysis suggests that successive blood meals, such as were given to the sandflies in previous years, were not conducive to the optimum multiplication and development of *L. donovani* in *P. argentipes*, and the large proportion of " blocked " sandflies among those that had been fed on raisins supports this suggestion. It is possible that the successive blood meals may also have adversely affected the infectivity of the flagellates.

Strickland (C.) & Roy (D. N.). **Experimental Intestinal Myiasis.**— *Indian J. med. Res.* **28** no. 2 pp. 593–594, 1 ref. Calcutta, 1940.

Four experiments were carried out in Calcutta in 1931 on the survival of Muscoid larvae during their passage through the alimentary canal of small animals [*cf. R.A.E.*, B **27** 107 ; **28** 175]. A rabbit forcibly fed with a very large number of first-instar larvae of *Musca domestica vicina*, Macq., in milk remained healthy, and daily examinations of its stools did not show any larvae. Large numbers of first- and second-instar larvae of *Sarcophaga ruficornis*, Wied., were given to a dog with its morning's food. In the evening, it refused its meal and passed three liquid motions. On the next day, haemorrhagic stools were passed, and it again refused all food. About a week later, it recovered, but at no stage of the illness was any larva found in the stool. Large numbers of first- and second-instar larvae of *Chrysomyia megacephala*, F., were introduced into the stomach of a puppy with milk.

From the next day, it began to pass thin watery stools mixed with blood. Considerable wasting was noticed and the puppy died on the ninth day. Post-mortem examination showed that the stomach was considerably distended with gas and contained three intact adults of *C. megacephala* floating in a watery mucoid substance. No empty pupal case or larva was found in stomach or intestine. The presence of eggs of *C. megacephala*, given three hours after they were laid to a rabbit and a dog, could not be detected in their faeces.

Sundar Rao (S.). **Study of Filarial Infection in Ratanpur (Central Provinces).**—*Indian J. med. Res.* **28** no. 2 pp. 609–613, 1 map, 5 refs. Calcutta, 1940.

The author's attention having been drawn to the prevalence of elephantiasis in the village of Ratanpur, Central Provinces, while the neighbouring localities remained practically free of it, a study was made of the cause of the infection. The village is described. A survey in March 1940 showed that filariasis there is due exclusively to *Filaria* (*Wuchereria*) *malayi*, and the filarial diseases found are characteristic of this infection, *viz.*, elephantiasis of the limbs exclusively, lymphangitis and abscess. Out of a population of 2,000 examined, 78 had elephantiasis, and the microfilaria rate of a representative portion of the population was 16·23 per cent. In a mosquito survey, *Mansonia annulifera*, Theo., *M. uniformis*, Theo., *Culex vishnui*, Theo., *C. fatigans*, Wied., *Anopheles pallidus*, Theo., and *A. annularis*, Wulp, were found to be prevalent. The species of *Mansonia* were found to be breeding in most of the big reservoirs, all of which were covered with *Pistia*. Breeding of *C. fatigans* was restricted to small collections of water in broken pots near wells. An examination of mosquitos collected in dwelling houses revealed filarial infection in the two species of *Mansonia* only. *M. annulifera*, which is the commonest species in the area, is evidently the chief vector.

Roy (D. N.) & Siddons (L. B.). **On Continuous Breeding of Flies in the Laboratory.**—*Indian J. med. Res.* **28** no. 2 pp. 621–624, 1 fig., 7 refs. Calcutta, 1940.

A brief account is given of the process used for the continuous breeding of local species of Muscoid flies in India. Adults are caught in nature, and the gravid females are placed individually in lamp chimneys, the tops of which are closed with gauze. A thoroughly wet wad of cotton-wool is kept on top of the gauze, allowing communication with the outside air. The chimney is placed in a dish containing the appropriate egg-laying medium, *viz.*, meat for *Chrysomyia rufifacies*, Macq., *Synthesiomyia nudiseta*, Wulp, *C. megacephala*, F., *Sarcophaga dux*, Thoms., *S. ruficornis*, Wied., and *Lucilia cuprina*, Wied., horse-dung for *Musca domestica vicina*, Macq., *M. nebulo*, F., and *M. yerburyi*, Patton, and stool for *M. sorbens*, Wied., and *M. pumila*, Macq. (*vetustissima*, Wlk.). Carbohydrate, preferably as sugar or "gur," is provided for food either under the cotton-wool or in the dish. If the breeding medium is horse-dung, it should first be heated almost to boiling point in a closed receptacle and allowed to cool without being exposed to the air, to ensure freedom from contamination by other flies. Meat should not be boiled, as larvae will then not thrive on it, slightly putrid meat being most favourable, but to prevent its becoming

contaminated, glass stoppered cages should be used if possible for this medium. When the eggs or larvae have been deposited, the medium containing them is added to a larger quantity of the same medium in a bigger dish with a layer of dry sand at the bottom for pupation. The dish is kept in a fly-proof box, and the pupae are later removed to a separate cage for the adults to emerge. The adults pair readily in captivity, and the sex ratio is about 1 : 1, except in the case of *C. rufifacies*. With this species, it is necessary to breed from several wild females as the progeny of one individual are all of the same sex [*R.A.E.*, B **28** 104]. During summer in Calcutta, flies will oviposit 4–6 days after emergence, and the second batch of eggs will mature in the same period. In winter, when the atmosphere is colder and drier, this period and the life-cycle from egg to adult are prolonged. Where the winter is more severe, it may be necessary to heat the breeding cage to 75–80°F., and plenty of moisture should be provided.

Attention is drawn to the importance of providing hydrolysed protein diet for the nutrition of the ova, the correct amount of moisture in the culture medium, abundant air for the growth of the larvae and abundant food, and to the necessity of protecting the pupae from parasitic Hymenoptera, small species of which may penetrate the wire gauze of a fly-proof box.

Del Ponte (E.). **Error de información sobre la existencia de** *Anopheles pseudopunctipennis* **Theob., en los territorios de Misiones y Chaco (Argen.).** [An Error as to the Occurrence of *A. pseudopunctipennis* in the Territories of Misiones and Chaco, Argentina.]—*Rev. Inst. bact.* **9** no. 4 pp. 443–444, 5 refs. Buenos Aires, 1940.

The author draws attention to three erroneous records of the occurrence of *Anopheles pseudopunctipennis*, Theo., in the Misiones and Chaco territories of Argentina, and points out that this species is confined to the north-western part of the republic [*R.A.E.*, B **16** 145, etc.].

Del Ponte (E.). **Tres especies nuevas de** *Anopheles* **(Dip. Cul.) nuevas para la gobernación de Misiones.** [Three Species of *Anopheles* new to the Misiones Territory.]—*Rev. Inst. bact.* **9** no. 4 pp. 445–447. Buenos Aires, 1940.

Endemic malaria in Argentina has up to the present been connected with the presence of *Anopheles pseudopunctipennis*, Theo., but new cases continue to appear in regions far from the area of distribution of this species, which is, for instance, unknown in the province of Corrientes, where the disease has recently occurred. In the interior of the Misiones territory, 237 cases were observed from May to July 1931, including 222 primary infections, in the Bonpland district. Anophelines of the subgenera *Anopheles* and *Nyssorhynchus* (groups *Nyssorhynchus* and *Myzorhynchella*) occur in Misiones. Those of the subgenus *Anopheles* appear to be unimportant from the epidemiological point of view, but although species of the *Nyssorhynchus* group of the subgenus *Nyssorhynchus* have also been considered unimportant in northern Argentina, this view may have to be revised as far as Misiones is concerned. The author has taken three species of this group not previously recorded in Misiones, *viz.*, *A. darlingi*, Root, which in various parts of South America is considered a dangerous vector, *A. strodei*, Root, and *A. lanei*, Galvão & do Amaral, which was described from Brazil [*R.A.E.*, B **27** 226].

Vargas (L.). **El índice maxilar en algunos *Anopheles* americanos.** [The maxillary Index in some American *Anopheles*.]—*Rev. Inst. Salub. Enferm. trop.* **1** no. 3 pp. 275–289, 25 refs. Mexico, D.F., 1940. (With a Summary in English.)

In view of evidence that Anophelines likely to feed on man have a maxillary index of less than 14 or more than 15·5 [*cf. R.A.E.*, B **10** 53 ; **26** 36, etc.], the author records the maxillary indices of females of *Anopheles maculipennis aztecus*, Hffm., *A. pseudopunctipennis*, Theo., *A. albimanus*, Wied., and *A. quadrimaculatus*, Say, taken in houses in Mexico, and *A. hectoris*, Giaquinto, from Guatemala. They averaged 14, 11, 17, 14 and 13, respectively. *A. m. aztecus* and *A. quadrimaculatus* are therefore classed as zoophilous, and the others as anthropophilous. Data on the food preferences of *A. quadrimaculatus*, *A. albimanus* and *A. pseudopunctipennis* are quoted from the literature, confirming the validity of the classification based on maxillary indices, and notes are given on the incidence of malaria and the occurrence of *A. pseudopunctipennis* in the State of Morelos. Of 1,371 persons examined from August to October 1938, 350 harboured malarial parasites. The spleen index was 38. In Temixco, Morelos, *A. pseudopunctipennis* is typically a domestic species ; it is very abundant in dwellings, and shows a preference for human blood [**27** 123].

Vargas (L.). *Anopheles* (*Anopheles*) *barberi* **en México.**—*Rev. Inst. Salub. Enferm. trop.* **1** no. 4 pp. 319–322, 1 fig., 8 refs. Mexico, D.F., 1940. (With a Summary in English.)

Three males of *Anopheles barberi*, Coq., were taken in October 1940 in a house at Imuris, in the State of Sonora, Mexico, this being the first record of the species outside the United States, where it is widely distributed. Some time previously, *Anopheles maculipennis freeborni*, Aitken [*R.A.E.*, B **28** 122] was taken in the same locality, this also being a first record for Mexico.

Papers noticed by Title only.

Tokunaga (M.). **Ceratopogonidae and Chironomidae from the Micronesian Islands** [including several new species] **with Biological Notes by Teiso Esaki.**—*Philipp. J. Sci.* **71** no. 2 pp. 205–230, 3 pls. Manila, 1940.

Tokunaga (M.). **Biting Midges from the Micronesian Islands (Diptera, Ceratopogonidae)** [including several new species] **with Biological Notes by Teiso Esaki.**—*Tenthredo* **3** no. 2 pp. 166–186, 1 pl., 15 figs. Shinomiya, 1940.

Tokunaga (M.). **Biting Midges from Japan and Neighbouring Countries, including Micronesian Islands, Manchuria, North China and Mongolia (Diptera, Ceratopogonidae)** [including several new species].—*Tenthredo* **3** nos. 1 & 2 pp. 58–165, 1 pl., 90 figs. Shinomiya, 1940.

Del Ponte (E.). **Descripción de la terminalia macho de *Anopheles annulipalpis* L. Arr. (Dipt. Culicidae).** [Description of the male Terminalia of *A. annulipalpis*, Arrib.]—*Rev. Inst. bact.* **9** no. 5 pp. 602–603, 1 pl., 1 ref. Buenos Aires, 1940.

Jordan (K.). **Cinco nuevos Siphonapteros de la República Argentina.** [Five new Siphonaptera from the Republic of Argentina.]—*Rev. Inst. bact.* **9** no. 5 pp. 605–622, 10 figs. Buenos Aires, 1940. [Translation : see *R.A.E.*, B **28** 59.]

DE LA BARRERA (J. M.). **Estudios sobre peste selvática en Mendoza.** [Studies on sylvatic Plague in Mendoza.]—*Rev. Inst. bact.* **9** no. 5 pp. 565–586, 7 figs. Buenos Aires, 1940.

Epizootics of plague among field rodents occurred in the province of Mendoza (Argentina) in 1937 and 1939, but were associated with less than a dozen cases in man. When the second outbreak began, the author was investigating the manner in which the infection persists from one epizootic to the next and the degree to which domestic rats are of importance in spreading it from wild rodents to man. Lists are given of the rodents observed and of the fleas taken on them. No species of *Xenopsylla* or *Ceratophyllus* (*Nosopsyllus*) were found on more than 2,000 wild rodents taken in various localities, so that if contact with domestic rats occurred, it must have been extremely rare. In Mendoza, domestic rats were found only in the immediate vicinity of dwellings, and their only contact with wild rodents would be that resulting from the entry of the latter into houses, when attracted by stored cereals. No case of plague was observed among domestic rats in Mendoza. Such cases have occasionally occurred throughout Argentina, and they have recently been so common in the northern part of the republic that the possible spread of rural plague to the domestic rat should not be disregarded.

The number of fleas per rodent was high in winter and fell considerably in summer. Infected fleas were found in the summer of 1937–38 after the winter outbreak of plague had ended. In December 1939, after the second epizootic, lesions of acute plague were found in 2 dead individuals among 1,189 examples of *Microcavia australis* examined. A few infected rodents would be sufficient to maintain the infection between epizootics.

LEVER (R. J. A. W.). **Entomological Notes. 2. A Mosquito hitherto not recorded in Fiji.**—*Agric. J. Fiji* **11** no. 3 p. 82, 3 refs. Suva, 1940.

The author records the finding of *Aëdes vigilax*, Skuse, in March 1940 in two buildings on the south coast of Viti Levu. As this species was not in Paine's list of Fijian mosquitos [*R.A.E.*, B **23** 271], which was the result of several years' intensive collecting, it has presumably been introduced from Melanesia during the last few years.

BUONOMINI (G.). **Anofelismo e bonifiche. Studi sulla fauna anofelica dei Consorzi di Bonifica del basso Volturno (Napoli).** [Anophelines and Land Reclamation. Studies on the Anopheline Fauna in the Reclamation Association Areas on the lower Volturno (Naples).]—*Riv. Malariol.* **19** (1) no. 3 pp. 130–148, 1 map, 2 graphs, 7 refs. Rome, 1940. (With Summaries in English and German.)

An account is given of observations from June 1937 to November 1938 on the Anopheline fauna in an area on the banks of the lower reaches of the river Volturno, in the province of Naples, where land reclamation was in progress, with consequent changes in the use of the land and agricultural practices. From May to October 1938, adults were caught every fortnight in a number of dwellings and animal quarters, and the females that could be induced to oviposit were identified by the eggs they laid.

Anopheles maculipennis, Mg., races *maculipennis* (*typicus*), *messeae*, Flni., *labranchiae*, Flni., and *melanoon*, Hackett, occurred throughout

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the area, but race *sacharovi*, Favr (*elutus*, Edw.) was found on the left but not on the right bank of the Volturno, in spite of the presence there of brackish marshes. The relative frequency of the races varied according to the degree of reclamation of the different sections of the area. Races *labranchiae* and *sacharovi* predominated in an unreclaimed section, from which race *maculipennis* was absent. Race *sacharovi* was rare or absent, and *labranchiae* formed 30–50 per cent. of all the Anophelines taken, in a section in which reclamation was in an early stage, but both races were absent from one in which reclamation was nearly complete. The fact that the abundance of these two races was inversely proportional to the degree of reclamation confirms observations on race *sacharovi* in Venetia [*R.A.E.*, B **25** 289].

There was also a seasonal variation in abundance, and *A. claviger*, Mg. (*bifurcatus*, auct.), the only other Anopheline recorded, was taken only in October. The exact causes of this seasonal fluctuation are not known, but it is considered that variations in the characteristics of the breeding places are the most important. For instance, the greater abundance of the typical race in May and October, as compared with other months, must be due to the breeding places having a low, uniform temperature and a salinity reduced by spring and autumn rains, while the increased numbers of *melanoon* and *messeae* in July and August are probably due to these species requiring higher temperatures, though they prefer water that is not very rich in salts. Another cause of seasonal fluctuation is the earlier disappearance, during dry weather, of breeding places in one locality as compared with another.

The females that were caught in dwellings and oviposited comprised 134 of *labranchiae*, 12 of *sacharovi*, 28 of *melanoon* and 35 of *messeae*. The figures for animal quarters were 845 of *labranchiae*, 64 of *sacharovi*, 431 of *melanoon*, 374 of *messeae*, 51 of the typical race and 22 of *A. claviger*. Thus, *labranchiae* and *sacharovi* together represented about 51 and 73 per cent. of all the females taken in animal quarters and dwellings, respectively, which confirms the importance of these races in the maintenance of endemic malaria in the district.

Moise (R.). **Osservazioni sulla malaria di Assab e sull'anofelino che la trasmette.** [Observations on Malaria at Assab and on the Anopheline Vector.]—*Riv. Malariol.* **19** (1) no. 3 pp. 149–158, 5 figs. Rome, 1940. (With Summaries in English and German.)

From December 1935 to April 1936, 25 cases of malaria were recorded among about 500 Italian naval personnel at Assab, Eritrea, and others occurred among the Italian civil population. *Plasmodium vivax* predominated, and no severe forms of the disease were observed. Malaria was rare among the adult natives, but common in the children; *P. falciparum* was predominant in them. The only Anopheline present was *Anopheles culicifacies*, Giles, which had not previously been recorded from the Ethiopian region. It bred in wells and cisterns, and was readily controlled by covering and oiling breeding places, and destroying abandoned wells.

Mohyddin Farid. **Malaria Infection in *Anopheles sergenti* in Egypt.**—*Riv. Malariol.* **19** (1) no. 3 pp. 159–161, 4 refs. Rome, 1940. (With a Summary in Italian.)

In August 1939, an epidemic of malaria occurred in two small villages on the eastern edge of the Nile Delta. Larvae of *Anopheles*

sergenti, Theo., were found in a large drain near them and were particularly abundant in small pools of seepage water on the sloping sides. A very few larvae of *A. coustani*, Lav., and *A. pharoensis*, Theo., also occurred in the drain. Adults of *A. sergenti* were found in houses in the villages, especially on spiders' webs in the darkest corners, and also in crude shelters in the courtyards used for stabling cattle and goats. *A. pharoensis*, which is generally considered to be the vector in the Delta [*cf. R.A.E.*, B **27** 137], seemed comparatively rare. The author had usually been able to trap large numbers of this species by means of a tent in which a man slept, but only 9 entered the tent in one of the villages, though 559 had been caught in the same tent in another locality a few nights before. *A. sergenti* had never been taken in this tent and did not enter it in the village, though it was abundant in the neighbouring houses. Gland dissections showed malaria sporozoites in 6 out of 220 females of *A. sergenti* from the two villages and in none of 1,734 of *A. pharoensis* taken throughout the summer in various parts of the Delta.

Pampana (E.) & Casini (G.). **Studi di epidemiologia malarica in Sardegna.** [Studies on the Epidemiology of Malaria in Sardinia.] —*Riv. Malariol.* **19** (1) no. 5 pp. 273–289, 6 figs., 13 refs. Rome, 1940. (With a Summary in German.)

The authors studied the seasonal epidemiology of malignant tertian malaria (caused by *Plasmodium falciparum*) in two villages in Sardinia in 1938–39 by making frequent records of the spleen and parasite indices of 66 individuals of all ages out of a total population of 234. It is known that infection by *P. falciparum* rarely persists in man for more than 8–9 months, and the authors therefore consider that the first cases of malignant tertian at the beginning of the epidemic season (in July) were new infections and not relapses; the number of crescent carriers in the pre-epidemic season was sufficient to account for the epidemic.

The Anophelines were studied by the examination of adults caught in dwellings and in a pig-sty, of larvae, and of the breeding places. The species present were *Anopheles claviger*, Mg., *A. algeriensis*, Theo., and *A. maculipennis*, Mg., which was represented exclusively by race *labranchiae*, Flni., and was presumably the vector, since cases of malaria were associated with proximity to its breeding places. A graph is given showing the frequency of the adults of *A. maculipennis* in relation to the weekly averages of temperature and relative humidity. It is concluded that hibernating females leave their winter quarters from the end of February onwards, since larvae were observed during the first week in March and first-generation adults appeared in April. In general, the population increased as the average weekly temperature rose from 15 to 25°C. [59 and 77°F.], but decreased at higher temperatures. It reached a peak at the beginning of June, fell rapidly in July and then remained at a fairly constant low level until it rose again with a fall in temperature in September.

Brambilla (A.). **Il problema della malaria a Dire Daua.** [The Malaria Problem at Diredawa.]—*Riv. Malariol.* **19** (1) no. 5 pp. 290–309, 1 map, 6 figs. Rome, 1940. (With Summaries in English and German.)

The author describes the topography and climate of Diredawa and gives the results of investigations on malaria carried out there from

April 1939 to February 1940 in view of the spread of the disease that accompanied the great influx of soldiers and workmen due to the Italian occupation. The author found that a number of supposed cases were due to other diseases, such as relapsing fever and dengue, which was common and related to the widespread occurrence of *Aëdes aegypti*, L. The malaria was endemic in the town and not severe, the prevalent form being benign tertian (*Plasmodium vivax*). It is severe, however, in the neighbouring zone of low plateau and mountain slopes. Anopheline breeding places were found in the bed of a stream that flows down from the Harrar plateau, passes about two miles from the town and then disappears in the sands. The native village lies between it and the town and thus affords some protection to the latter. Anophelines were rare and not domestic, even *Anopheles gambiae*, Giles, which is the chief vector, being uncommon in dwellings. The other Anophelines taken in native dwellings were *A. dthali*, Patt., which is suspected of being a vector, *A. pretoriensis*, Theo., *A. cinereus*, Theo., *A. turkhudi*, List., and *A. funestus*, Giles, which was very rare. Larvae of all these species occurred in the breeding places, but as these are usually confined to a short stretch of the stream, control was not difficult. Paris green was applied weekly to the breeding places, small pools were destroyed and domestic water receptacles were covered. As a result, the number of new infections contracted in Diredawa in 1939 was very small. It is recommended that all dwellings should be screened, and in view of the small size of the adults of *A. dthali*, the ordinary screens should be varnished in order to reduce the width of the meshes.

Report on Terminology in Malaria.—*Bull. Hlth Org. L. o. N.* **9** no. 2 pp. 131–246. Geneva, 1940.

This report, which is designed to standardise terms commonly employed in connection with the epidemiology of malaria, comprises the results of discussions by a sub-committee of the Reporting Committee of the Malaria Commission (Sir S. R. Christophers, L. W. Hackett, Ed. Sergent, W. Schüffner and M. Ciuca representing the Secretary of the Commission). It is in two parts, a systematically arranged commentary in which the terms are placed in their proper perspective and context and explained, and an alphabetically arranged glossary of the terms, giving their French equivalents and brief definitions, showing which are suitable for use and serving also as an index to the commentary. The commentary is divided into three sections, one dealing with the malaria parasites and the infections to which they give rise, one with malaria in the human community, and one with the insect vector.

It is suggested that, apart from the use of *Anopheles* as a generic name, the term anopheles should be used as a popular name both singular and plural for members of the tribe ANOPHELINI. Questions relating to purely zoological nomenclature of species and varieties of anopheles are not within the scope of the report, but it is stated as regards the subspecies that they should be called varieties and the varietal name preceded by the abbreviation var. without a comma. The term race has frequently been used in connection with the forms of *A. maculipennis*, Mg. This term, however, usually denotes subspecific differentiation not amounting to definable morphological distinction, while it is generally agreed that the forms of *A. maculipennis* commonly

referred to as races have some of the characters of species [*cf. R.A.E.*, B **29** 41, etc.], and their status appears to be not unlike that of other (named) varieties of anopheles. It is considered undesirable that their nomenclature should not conform to that employed for the latter. It is usual in the case of varieties to retain the name of the species without any varietal designation for the type form. In the case of *A. maculipennis*, however, the convention of using the name var. *typicus* to designate the supposed typical form (that described by Falleroni as *basilei*) seems to be without objection.

In a sub-section on stages of growth and development, the stages of metamorphosis are given and the gonotrophic cycle is dealt with. Though the development of the ovaries can be divided into five stages as shown by Christophers (ovum without marked granules ; granules occupying half or less of the follicle ; granules occupying over half the follicle, which, however, is not elongated ; follicle elongated or having the shape of the mature egg, but superficial structures not evident ; egg fully formed and floats visible), this does not show the age of the females ; Perry's classes of females [**20** 280], indicating the relation of age to the appearance of the wings, are therefore given. These are : wing markings clear and fringe complete ; wing markings fairly clear, but fringe worn ; wings shabby and fringe much worn ; and wings threadbare.

The remaining sub-sections deal with life-history and behaviour, the anopheles community, relation to infection, and the terms applied to methods of control directed against the vector.

Hu (S. M. K.). **Studies on the Susceptibility of Shanghai Mosquitoes to experimental Infection with** *Microfilaria malayi* **Brug. II.** *Culex tritaeniorhynchus* **Giles.**—*Peking nat. Hist. Bull.* **15** pt. 2 pp. 93–96, 4 refs. Peiping, 1940. **III.** *Anopheles hyrcanus* **var.** *sinensis* **Wiedemann.**—*T. c.* pp. 97–101, 4 refs.

These two papers record experiments, similar to one already noticed [*R.A.E.*, B **29** 22], that were carried out in 1939 in Shanghai to test the susceptibility to infection with *Filaria* (*Microfilaria*) *malayi* of *Culex tritaeniorhynchus*, Giles, and *Anopheles hyrcanus* var. *sinensis*, Wied., respectively. The adults used were reared from larvae collected locally. Of 47 and 85 adults of *C. tritaeniorhynchus* that engorged on a case with a moderately heavy infection of *F. malayi* on 15th and 20th June, respectively, 46 and 84 were negative for filarial larvae when dissected 8–24 days after infection. The remaining two, dissected 14 and 21 days after infection, each harboured one infective larva. The importance of *C. tritaeniorhynchus* in the transmission of *F. malayi* in central China depends on its status as a household mosquito there. Of 11,740 mosquitos collected during 1934 in a man-baited trap in a village, 671 were of this species. It was most abundant between mid-July and mid-August, when only *A. hyrcanus* var. *sinensis* and *C. pipiens* var. *pallens*, Coq., were taken in greater numbers, so that at this time of year, it may play a minor rôle in the transmission of *F. malayi*, in spite of its low susceptibility to infection. Of 34 adults of *A. hyrcanus* var. *sinensis* given an infecting feed on 20th June, 28th July or 4th August, all but one contained larvae, and all the larvae in those dissected 8 or more days after the infecting feed were infective. From 1 to 46 infective larvae were found in a single mosquito, the greatest numbers being in those that had engorged

on a heavily infected case. The high susceptibility of *A. hyrcanus* var. *sinensis* to experimental infection with *F. malayi* was thus confirmed [*cf.* **21** 191 ; **22** 105 ; **23** 290]. This, together with the fact that it is one of the most common household mosquitos in central China, indicates that it may play an important part in the transmission of *F. malayi* in that region.

ROBERTSON (R. C.) & CHANG (T. L.). **Malaria Survey in Western Yunnan, Lungling Area and Lushih County.**—*Chin. med. J.* **58** no. 4 pp. 446–455, 1 fig., 8 refs. Peiping, 1940.

This paper deals with malaria in that portion of the China-Burma Highway stretching from Lungling through Mangshih to the Burma frontier where it is hyperendemic [*R.A.E.*, B **28** 156]. The topography, population and climate are briefly described. The chief breeding places of anopheles are bodies of stagnant water and slow or fast moving streams. All are affected by the amount and distribution of the summer rains, and the state of the rice-fields has a distinct bearing on malaria prevalence as the season advances. Among thousands of patients who came to health centres at Mangshih and Lungling during July–October 1939, 53 and 39 per cent. had malaria, as compared with 8 and 13 per cent. among patients visiting health centres at two towns on the Highway but outside the highly malarious region during the same period. Among native children under 14 years of age examined at six localities in the region, the parasite index was 18·9. There was no significant variation among the villages studied. By far the commonest infection is *Plasmodium falciparum*, which was prevalent in the low-lying plains. *P. malariae* was rare except in one town, where 31 per cent. of the blood smears examined were positive for it. *P. vivax* was the prevailing infection in the upper plains of high altitude.

ROBERTSON (R. C.). **A Malaria Survey on the China-Burma Highway.** —*Trans. R. Soc. trop. Med. Hyg.* **34** no. 4 pp. 311–332, 4 pls., 2 maps, 8 refs. London, 1941.

Practically all the information in this paper on malaria on the China-Burma Highway has already been noticed [*R.A.E.*, B **28** 156 ; **29** 35 ; and preceding abstract]. The results of dissections of mosquitos for malaria parasites [**28** 157] are brought up to date by the inclusion of data on a further 215 individuals and are analysed, and the sources from which the mosquitos were obtained are described. *Anopheles minimus*, Theo., the greatest prevalence of which, at the end of the monsoon rains [**29** 35], coincides with the peak of malaria incidence, is thought to be definitely associated with endemic malaria. *A. jeyporiensis* var. *candidiensis*, Koidz., was second to it in the proportion found infected, and *A. maculatus*, Theo., is also a vector, but is not so important as *A. minimus*, except in the dry season. *A. annularis*, Wulp, and *A. hyrcanus* var. *sinensis*, Wied., are thought to be of about equal importance. The latter is one of the common species in dwellings and is widely distributed throughout the province, yet its infectivity is not so high as that of other common species of the region. Although it is recognised as the principal vector of malaria in other parts of China, the author believes that it is not one of the most important species in Yunnan, in view of the results obtained by previous workers

there [**23** 129 ; **25** 99] and the fact that out of 309 females examined he found only 8 infected (3 with gut infections only), all among those collected in the bed-nets of infected persons with a high gametocyte rate. If this proved to be the case, malaria control work would be much simplified, as it would be unnecessary to take the rice-fields into consideration, and it might be possible to lower the incidence of the disease by dealing with the breeding places of *A. minimus* by oiling or drainage or the application of Paris green. It is thought that sub-soil drainage on a large scale is not practicable, but with the use of bamboo pipes it could be applied to a limited extent round the transport depots. A better policy, however, would be to choose sites for the new stations on healthy ground. Villages will develop round the depots, and some control of the type of housing would be advisable. The main recommendations include building mosquito-proof shelters for the road repair gangs at suitable points, taking measures against the larvae of *A. minimus* and providing mosquito nets of a suitable mesh, those at present in use being of too large a mesh to exclude *A. minimus*.

WILLIAMS jr. (L. L.). **Malaria on the China Burma Highway.**—*Amer. J. trop. Med.* **21** no. 1 pp. 1–11, 1 graph, 3 refs. Baltimore, Md., 1941.

In this presidential address, delivered at a meeting of the American Society of Tropical Medicine in November 1940, the author records that he and others were sent to China to co-operate with the Chinese National Health Administration in the control of epidemics on the China-Burma Highway. As malaria is the most important problem [*cf.* preceding abstracts], equipment was assembled for establishing a laboratory for its diagnosis and instruction concerning it, and Chinese doctors joined the party to learn to make malaria and mosquito surveys and to control the disease. Brief descriptions are given of the conditions under which the road was built and of the inhabitants of the region and their way of life, and the history of malaria in Yunnan is outlined. There was no evidence that it is prevalent on the eastern part of the road, but the rates rose to the westward as the elevation fell. The highest found on the survey were in Chefang during January, which is the time of lowest infection rates, so headquarters and a laboratory were established there. During the rains of June to October, it seems certain that the rates must be 100 per cent. Of the blood positive cases among 237 children examined, 30 per cent. were *Plasmodium vivax*, 67 per cent. were *P. falciparum* and 3 per cent. were mixed. It is evident that malignant tertian malaria (*P. falciparum*), which was found as far east as Lungling, has been moving eastward since the opening of the road, but the author gives reasons to support his belief that its eastward spread will not continue with great rapidity. No mosquitos were observed east of Pao Shan during a visit in December, and it is doubtful if anopheles production is at all high even in midsummer. If malignant tertian appears, its control should be relatively simple.

During surveys between December 1939 and May 1940, 11 species of *Anopheles* were identified, namely : *A. aitkeni*, James, *A. barbirostris*, Wulp, *A. hyrcanus* var. *sinensis*, Wied., *A. gigas* var. *baileyi*, Edw., *A. minimus*, Theo., *A. jeyporiensis* var. *candidiensis*, Koidz., *A. annularis*, Wulp, *A. maculatus*, Theo., *A. splendidus*, Koidz., *A. stephensi*, List.,

and *A. tessellatus*, Theo. The author agrees with Robertson [see preceding abstract] that *A. minimus* is the most important local vector. He also states that *A. hyrcanus* is a vector of no importance in other areas and is infected only when a better vector species maintains a high malaria rate, and that he therefore believed the same would hold true in Yunnan. However, in case these deductions proved erroneous and measures additional to those against the other vectors were needed, arrangements were made for breeding *Gambusia* to stock the rice-fields, and an extra supply of Paris green was obtained to apply at weekly intervals to nearby fields and so almost wholly control the anopheles within an eighth of a mile of the town. He considers that these measures should so reduce the density of such a poor vector as *hyrcanus* as to assure malaria control in the absence of a better one. W. C. Sweet, working under the Rockefeller Foundation, established his headquarters in the laboratory at Chefang, and made his primary study a determination of the natural infection rate, if any, in *A. hyrcanus* var. *sinensis* when *A. minimus* was controlled. It is stated in a footnote that Sweet reports that no infected *hyrcanus* had been found up to September 1940. Malaria control was begun at the two worst centres. Sections of locally grown bamboo were used as sub-soil tile, and the techniques of distributing oil and pyrethrum emulsion as larvicides and of diluting Paris green and distributing it were demonstrated. A nursery for the propagation of shade bushes was set up and a stock of *Gambusia affinis* obtained. A malaria unit staffed by Chinese physicians was established.

KUMM (H. W.). **The Eggs of some Costa Rican Anophelines.**—*Amer. J. trop. Med.* **21** no. 1 pp. 91–98, 4 pls., 14 refs. Baltimore, Md., 1941.

Some 30 photographs are given of the eggs of 9 species, *viz.*, *Anopheles albimanus*, Wied., *A. argyritarsis*, R.-D., *A. strodei*, Root, *A. pseudopunctipennis*, Theo., *A. anomalophyllus*, Komp, *A. apicimacula*, D. & K., *A. neomaculipalpus*, Curry, *A. punctimacula*, D. & K., and *A. vestitipennis*, D. & K. Comments on their characteristics are made in the text of the paper, and a table is given showing their measurements and the number of ridges on, and the sizes of, their floats. Those of the last five species had not previously been described. There was no evidence that the eggs of *A. albimanus* laid at the beginning of the dry season were any larger than those laid during the preceding rainy months [*cf. R.A.E.*, B **28** 61]. Variations were found in the eggs of *A. punctimacula* and *A. vestitipennis* and occurred at times in a batch of eggs laid by a single female.

BATES (M.). **Studies in the Technique of raising Anopheline Larvae.**—*Amer. J. trop. Med.* **21** no. 1 pp. 103–122, 9 refs. Baltimore, Md. 1941.

The following is taken from the author's introduction and summary. This paper deals with experiments on the rearing of anopheles larvae carried out more or less concurrently with others already noticed [*R.A.E.*, B **28** 29] and using the same technique, but with the object of finding a combination of mineral salts and food that would serve as a satisfactory basis for rearing larvae under standard conditions. All the experiments, except those designed for the comparison of

various species or varieties, were made with *Anopheles maculipennis* var. *atroparvus*, van Thiel, from the colony from northern Germany. Two types of media were sought: "routine" for the purpose of obtaining adults and "standard" to serve as a basis for special experiments with larvae. The chief requirements in a routine medium are simplicity and reliability, and these seemed to be met best by a combination of mud, rain water and bread crumbs [*cf.* **28** 85, 124], which proved itself well adapted to a wide variety of species and circumstances. A standard medium should be made up in such a way that it can be reproduced in any laboratory, so that larval experiments may be duplicated and compared. It would be necessarily based on distilled water. No entirely satisfactory one was found, but "Medium S," made up of calcium sulphate, sodium chloride and magnesium sulphate, in the proportions of 0·5, 0·5 and 1·0 part per thousand, respectively, made the best medium for early growth when dried bread crumbs were added as food. Of the substances tried, bread crumbs seemed to be the most satisfactory organic food for both routine and standard purposes. The suitability of various natural waters for anopheles breeding was compared, and results obtained with a few water samples are given. In the only case carefully studied, the unsuitability of the water seemed to be due to a high nitrate content. The addition of even very small amounts of nitrate to otherwise favourable media had an adverse effect on growth. From studies of the effect of soil (mud and sand), it was concluded that the mud used in the routine breeding method favoured larval growth by furnishing necessary minerals in solution, by serving as a source of organic food, and by acting as an absorbing agent for unfavourable materials. The comparison experiments showed that the standard method was about equally favourable for *A. superpictus*, Grassi, and *A. maculipennis*, Mg., vars. *atroparvus*, *labranchiae*, Flni., and *typicus*, but that it was inadequate for *A. maculipennis* var. *sacharovi*, Favr. *A. superpictus* was found to be more tolerant of nitrates than the other species, but more exacting in its mineral requirements. In the routine medium, all these forms, and also *A. claviger*, Mg., showed equally favourable growth and survival.

HILL (R. B.) & CAMBOURNAC (F. J. C.). **Intermittent Irrigation in Rice Cultivation, and its Effect on Yield, Water Consumption and *Anopheles* Production.**—*Amer. J. trop. Med.* **21** no. 1 pp. 123-144, 4 refs. Baltimore, Md., 1941.

Experiments on the intermittent irrigation of rice-fields in southern Portugal for the control of the malaria vector [*Anopheles maculipennis* var. *atroparvus*, van Thiel] were begun in 1935 [*R.A.E.*, B **26** 218] and continued on an increasing scale in 1936-39. As the life-cycle of the anopheles occupies at least 18 days during the warmest part of the summer under local conditions, intermittent irrigation, with the water completely absent once every 16–17 days, should prevent the emergence of any adults. This can be obtained in plots that drain readily and completely, but under field conditions, the inevitable small depressions may not be completely dry when it is time to turn the water on again, and some seepage may take place. However, it was found that larvae do not make efforts to migrate when the water level is lowered, so that the number of adults emerging from the small pools that are left is correspondingly small. It would be possible to treat these few pools

with a larvicide or to fill them, but this was not done, as it was desired to ascertain what would occur under routine conditions of draining and flooding. In the large-scale experiments over the years 1936–39, a reduction of 80 per cent. was effected in the number of large larvae and a somewhat larger reduction in the total number of larvae. During the first three years, most of the dips were made near spots that had held residual water, so that the results are somewhat unfavourably loaded. Over large parts of the field no larvae were found. With both continuous and intermittent irrigation, the number of larvae decreased as the season advanced. In one year, four small beds were drained perfectly three times during the season, and the number of larvae reduced to zero on each occasion.

It was found that larvae cannot live long in the absence of free surface water. On earth with a moisture content of 20 per cent., survival was possible for only two hours in the shady open places and for twelve hours in the laboratory. A light loam with 20 per cent. moisture is just losing its surface sheen, while with 15 per cent. moisture it has a dull but moistened appearance. Hence, in practice, it is not necessary to reduce a field to apparent dryness, but only to dry it till the surface film is lost. However, fields were often allowed to dry till the earth was hard and cracked without the rice being harmed in any way. Intermittent irrigation usually caused some increase in the yield of the rice and slightly improved its physical qualities, but it appeared that the effect on some varieties and in some soils may be somewhat variable. The amount of water used in intermittent irrigation is less than in continuous flooding. Intermittent irrigation requires special preparation of the fields and of the irrigation and drainage systems, and needs close supervision, but once the fields are set up for it, the economic advantages resulting from an increased yield and better conditions for labour stimulate interest on the part of the growers and the practice is spreading slowly. It is concluded that it is the only feasible method so far evolved for the control of anopheles breeding in the rice-fields of Portugal.

COUTINHO (J. O.). **Nota sôbre flebótomus sul-americanos.** [South American *Phlebotomus*.]—*Bol. biol.* (N.S.) **4** no. 2 pp. 181–183, 7 figs., 6 refs. São Paulo, 1939. [Recd. 1941.]

Phlebotomus (*Flebotomus*) *antunesi*, sp. n., is described from a single male, which was caught by means of animal bait on the banks of the Amazon, together with 5 females identified as *P.* (*F.*) *davisi*, Root. A re-description of the female of *P. davisi* is given from this material. Root's description was based on males from the Amazon and females from Bahia [*R.A.E.*, B **22** 206], and in view of this discrepancy in distribution the record of females from the same fauna as the males described by Root is of interest.

PINTO (C.). **Disseminação da malária pela aviação ; biologia do *Anopheles gambiae* no Brasil.** [The Spread of Malaria by Aviation ; the Biology of *A. gambiae* in Brazil.]—*Bol. biol.* (N.S.) **4** no. 2 pp. 196–207, 3 figs. São Paulo, 1939. (With a Summary in English.) [Recd. 1941.]

Practically all the information in this account of *Anopheles gambiae*, Giles, in Brazil was included in papers already noticed [*R.A.E.*, B **27** 218 ; **28** 168]. A list is given of the places in Rio Grande do Norte and in Ceará [*cf.* also **29** 58] in which it was found up to January 1939.

Antunes (P. C. A.) & Coutinho (J. O.). **Notas sôbre flebotomos sul-americanos. II. Descrição de *Flebotomus whitmani* n. sp. e da armadura bucal de algumas espécies.** [Notes on South American *Phlebotomus*. II. Description of *Phlebotomus whitmani*, sp. n., and of the buccal Armature of some Species.]—*Bol. biol.* (N.S.) **4** no. 3 pp. 448–453, 6 figs., 6 refs. São Paulo, 1939. [Recd. 1941.]

Phlebotomus (*Flebotomus*) *whitmani*, sp. n., is described from males and females taken in the State of Bahia, and figures are given of the buccal armature of *P. intermedius*, Lutz & Neiva, *P. alphabeticus*, Fonseca, *P. fischeri*, Pinto, *P. migonei*, França, *P. monticolus*, Costa Lima, and *P. evandroi*, Costa Lima & Antunes, all of which occur in Brazil.

Pinto (C.) & Lins de Almeda (J.). **Sobre o *Amblyomma neumanni* Rib., 1902, parasito do homem na Argentina.** [*A. neumanni*, a Parasite of Man in Argentina.]—*Ann. Acad. Brasil. Sci.* **11** no. 2 pp. 113–124, 1 pl., 4 figs. Rio de Janeiro, 1939. [Recd. 1941.]

The authors quote the original descriptions of *Amblyomma neumanni*, Ribaga, and *A. furcula*, Dön. [*cf. R.A.E.*, B **23** 107], confirm the view that the latter is a synonym of the former, and redescribe the female. They state that this tick, which occurs in Argentina and Uruguay and has been recorded from various domestic and other animals, also attacks man. A list is given of references to it in the literature.

Mellanby (K.). **The Incidence of Head Lice in England.**—*Med. Offr* 1941 repr. 4 pp., 2 figs., 5 refs. London, 1st February 1941.

The investigation reported in this paper was made to find the cause of the discrepancy between the official data of the school medical service on the incidence of *Pediculus humanus capitis*, DeG., in England and the observations made in the reception areas following the evacuation of September 1939, and to discover accurately the prevalence of this louse. The method adopted was to examine the data on the incidence of head lice on patients received into hospitals, principally those treating infectious diseases, in various parts of the country. It is considered that such patients are fairly representative of the population of the area served by the hospital. The data are based on about 60,000 observations. The figures from 10 industrial towns, including all those cities in England with over 400,000 inhabitants, showed that the degree of infestation in these towns is very high, practically 50 per cent. of the children 2–4 years of age and of the girls between the ages of 5 and 14 being infested. The degree of infestation among boys of school age was lower and among adult males did not exceed 2 per cent., but the incidence among women was never less than 5–10 per cent. Persons over 70 years of age were no more heavily infested than other adults. There were considerable differences in the results from the various cities, but not in the ratio between the degrees of infestation in the different age groups. In the most heavily infested town, 62 per cent. of the girls between the ages of 9 and 13 were infested and in the cleanest 36 per cent. In 5 of the towns, over

50 per cent. of the girls of this age group were infested. In 4 rural communities in the south of England, less than 5 per cent. of the children were infested. The results suggested that in the rural areas the figures published by the school medical service give a true representation of the conditions and that the examinations are efficient, whereas in the cities, where the official figures are not very dissimilar from those published by the rural authorities, most of the infestations are undetected.

An examination of hospital records in three towns indicated that though there may be some seasonal fluctuation in the degree of infestation, the rate does not rise during the summer holidays; in some years, the figures for August and September were the lowest of the year. Hospital records obtained in rural areas for evacuee children entering during September 1939 showed up to 50 per cent. of the children to be infested and agreed closely with the results obtained in the home towns of these children. A few rural children became contaminated, but the evacuee children were soon satisfactorily freed of lice and no permanent rise in the local infestation rate occurred. The great difference between conditions in town and country is attributed to the fact that parents in rural districts consider it a disgrace for their children to harbour head lice, whereas those in the towns attach less importance to this condition. The author believes that permanent eradication will be accomplished only by education. Factors believed to contribute to the high incidence of head lice are the fashion of permanently waving the hair, which results in its not being combed, lack of co-operation in some areas between the school medical service and the teachers, and above all a legal system that makes no provision for cleansing children under school age.

One method of control is to wet the hair thoroughly with about 4 oz. of a mixture of 3 parts methylated or surgical spirit and 1 part water, and keep it wet under a rubber cap for about an hour, at the end of which period all lice and nits will be dead.

Hobson (R. P.). **Sheep Blow-fly Investigations. VIII. Observations on Larvicides and Repellents for protecting Sheep from Attack.**—*Ann. appl. Biol.* **27** no. 4 pp. 527–532, 12 refs. London, 1940.

A dip may protect sheep from infestation by blowflies by preventing the development of conditions making them susceptible, by repelling the females, or by killing the eggs or young maggots in the fleece [*cf. R.A.E.*, B **26** 192]. In this paper, control by the last two methods is examined. Repellents were tested by periodically placing a piece of cotton-wool soaked in a standard attractant solution **26** 7 in the fleece of treated and control sheep and exposing them under field conditions (in Wales), and larvicides by periodically placing eggs of *Lucilia sericata*, Mg., on the skin under moist conditions [**26** 25 after the sheep had been dipped for 1 minute, and by feeding larvae on wool samples collected from the base of the fleece and moistened with an equal weight of serum. The organic compounds used as larvicides were also tested as repellents. They were applied in the form of emulsions, and in most cases refined petroleum oil was included.

Of the larvicides tested, the insoluble arsenites of lead and calcium were about as effective as the proprietary arsenic-sulphur powder, which contains a large proportion of water-soluble arsenic and gives

fair protection for about 3 weeks [*cf.* **26** 193–4]. Sodium fluosilicate was ineffective, although it had been shown to be toxic to larvae of *L. sericata* in laboratory trials. Barium fluosilicate was better, but as a very high concentration was used, it appears unlikely that it will replace arsenic. Dodecyl rhodanate (lauryl thiocyanate) gave excellent results at 0·5 per cent., both toxicity and repellent action lasting for 6 weeks, but the dip injured the skin on the backs of the sheep, apparently because the emulsion broke during dipping. At 0·2 per cent. this thiocyanate gave poor protection. Normal butyl carbitol rhodanate (β-butoxy-β′-thiocyanodiethyl ether) in the form of Lethane 384 [**28** 150] was not stable in the fleece, and the other oil-soluble synthetic insecticides tested gave protection for only a very short period. It is thought that the termination of immunity following an arsenic dip is not due to leaching by rain [**25** 283], but to the movement of the arsenic away from the skin owing to the growth of new wool and the movement of the yolk along the fibre. This limitation would apply equally to an oil-soluble substance. Experiments are in progress to determine whether longer protection is afforded by substances insoluble in both oil and water, and some compounds of this type were included in the experiments described. Lead arsenate was only moderately effective. However, a wetting agent was added to the dip, and subsequent work has shown that the protective properties of soluble arsenic dips are considerably reduced by the presence of a wetting agent in the fluid. When numbers of sheep are dipped, suint accumulates in the bath and imparts good wetting properties to the dip. This results in the sheep dipped last receiving poorer protection, and it probably explains why dips often fail when large numbers of sheep are dipped without the contents of the bath being changed.

Repellents were applied by spraying with 600 cc. of a 1, 3 or 10 per cent. emulsion or occasionally by dipping in a 0·5 or 0·8 per cent. emulsion. The sheep were exposed long enough to allow about five egg-batches to be laid on the controls. Repellent action was deemed to have terminated when more than one egg cluster was found if the controls were severely blown, or when eggs were present at all if there were few egg clusters on the controls. Substances with a pronounced odour, such as clove oil and *Tagetes* oil [**25** 245], were not successful repellents, as their effect was not sufficiently lasting, but better results were obtained with other vegetable oils. Of these, olive oil and cotton-seed oil, which at 10 per cent. gave protection for about 16 days, were the most promising; they probably owed their effectiveness to the development of rancidity, as oleic acid proved an excellent repellent, though it was unsuitable for use in dips or sprays since it irritates the skin. The results obtained with various samples of oil of tar varied considerably. The best, which at 10 per cent. gave protection for about 2 weeks, was dark and had a strong tarry smell. As none of the repellents, even at the high concentrations used, gave protection for longer than the arsenic dip, it is concluded that the effectiveness of dips now in use cannot be prolonged by the addition of any of them. It is also considered that the repellents are not effective for a sufficiently long time to be usefully incorporated in dressings for the prevention of re-strike, which usually takes place 2–3 weeks after treatment. Their chief value appears to be as protective sprays. If the sheep were penned and sprayed in groups with a fine mist, the high concentration of repellent necessary to give protection could be used, as the method is very economical.

Studies on the Physiology and Toxicology of Blowflies.

LENNOX (F. G.). **2. The Action of Stomach Larvicides on** *Lucilia cuprina.—Pamphl. Coun. sci. industr. Res. Aust.* no. 101 pp. 3, 5, 9–49, 5 figs., 47 refs., multigraphed. Melbourne, 1940.

LENNOX (F. G.) & WEBBER (L. G.). **3. The Toxicity of some Arsenicals to Larvae of** *Lucilia cuprina.—T. c.* pp. 3, 6, 51–67, 1 fig., 15 refs.

LENNOX (F. G.). **4. The Action of Contact Larvicides on** *Lucilia cuprina.—T. c.* pp. 4, 7–8, 69–131, 18 figs., 65 refs.

The following is largely based on the authors' summaries of the first two papers, which are the second and third of a series [*cf. R.A.E.*, B **28** 57]. Two methods are described for measuring the toxicity to larvae of *Lucilia cuprina*, Wied. [**29** 51] of stomach poisons incorporated in synthetic nutrient media [**28** 57]. In the first, sterilised eggs are placed on the media, and growth retardation of the larvae that hatch from them is measured photographically. Increasing the concentrations of boric acid, sodium arsenite and nicotine, the three substances used for studying the method, produced a progressive increase in the retardation of growth, which was most marked when a certain threshold concentration was exceeded and became less so as the concentration of poison was further increased. The growth-retarding influence of a poison was reduced by an increase in the nutritive property of the synthetic medium. In the second method, the rate of mortality of partly-grown larvae transferred to the media is recorded. The value of this method was demonstrated by preliminary trials with sodium arsenite, in which the mortality rate increased with the concentration of poison but decreased with the age of the larvae. The time required for the absorption of a lethal dose was measured for sodium arsenite by recording the rates of mortality of larvae fed on the toxic medium for known periods and then transferred to a non-toxic environment. It is thought that this method may afford useful data on the mode of action of certain poisons. A comparison is drawn between the two methods (growth retardation and rate of mortality), both of which were used to measure the toxicities of a wide range of materials. Amongst the most toxic were nicotine, phenothiazine [thiodiphenylamine], and arsenic and selenium compounds. Attempts to modify the structure of phenothiazine without affecting its toxicity were unsuccessful. Of a representative selection of dyestuffs, methylene blue and those belonging to the triphenylmethane group were the most effective. In conclusion, attention is drawn to the fact that each of these methods of measuring toxicity has a definite bearing on some particular aspect of the control of blowfly larvae on sheep. The growth-retardation method indicates how effectively a poison could prevent the development of strike if applied to the fleece before oviposition, the rate of mortality indicates its potentiality for destroying larvae in a well-established strike, and the time required to obtain a lethal dose should indicate the probable survival of larvae that have made contact with the poison and later escaped to a poison-free environment. On account of the high protein content of sheep serum, with which larvicides are mixed when applied to strikes, the toxicities of substances in the enriched medium are likely to be of greater practical significance than those determined in the basal medium.

The relative toxicities to larvae of *L. cuprina* of several well-known arsenicals incorporated in a synthetic medium were assessed by the

rate of mortality method. Although the compounds were compared both at equal percentage concentrations and at equivalent arsenic concentrations, the differences between their toxicities were approximately the same in both series. Thus, it was not possible to correlate the toxicity of a compound with its total arsenic content. However, there was some correlation between toxicity and arsenic dissolved by the enriched medium. The results showed that the arsenicals could be divided into two groups : the highly toxic compounds, comprising, in order of decreasing toxicity, barium arsenite, calcium arsenite, arsenic acid, Paris green and arsenious oxide, and the moderately toxic arsenates of zinc, aluminium, lead and calcium. The absence of pigment from the crops or guts of larvae that were kept on stained enriched medium containing toxic concentrations of sodium or calcium arsenite is taken to indicate that these arsenicals may not destroy the larvae through absorption of arsenic from the gut [*cf.* A **24** 81].

The following is substantially the author's summary of the last paper. A method is described for measuring the contact toxicities of liquids [*cf.* B **29** 52] by immersing prepupae of *L. cuprina* in them under standard conditions and determining the percentages unable to complete metamorphosis. The influence of concentration, time of contact and temperature are studied. The concentration-mortality curves for acetone, ethyl acetate and acetic acid, each diluted with water, methyl alcohol and ethyl alcohol, show that the steep inflexion of the typical sigmoid curve is displaced towards the less toxic component by an increase in the toxicity of either component. Owing to the difficulty of administering very small doses of the undiluted liquids, the time-mortality curves rise sharply during the first few minutes, and this rise becomes more acute with an increase in the toxicity of the test liquid. In fact, substitution of a highly toxic for a slightly toxic liquid, increase in the concentration of acetic acid, or increase in the temperature of acetone diminishes the length of the initial horizontal portion of the sigmoid curve. A semi-logarithmic relationship exists between the time for 50 per cent. mortality of *L. cuprina* and the concentration of acetic acid, or the temperature of acetone. Calculation of the temperature coefficients for acetone gives values of the same order of magnitude as previously recorded for the action of various chemicals on bacteria. A type of drug antagonism, which operates when small amounts of toxic liquids are added to practically non-toxic liquids, is noticeable, particularly when inhibition of pupation rather than fly emergence is used to measure mortality. The choice of one or other of these two criteria may have a considerable influence on the apparent relative toxicities of two compounds, because they do not always bear the same constant relationship to each other. The contact toxicities of hydrochloric acid and sodium hydroxide are approximately equal, and greater than those of weaker acids and alkalis. It is highly probable that the toxicities of inorganic acids and alkalis are a direct function of their hydrogen ion and hydroxyl ion concentrations, respectively. Measurements of the toxicities of a wide variety of pure liquid organic chemicals show that aliphatic halogenated and aromatic hydrocarbons are exceptionally potent, and in the normal aliphatic alcohols or fatty acids toxicity increases as the carbon chain lengthens within the homologous series. Isomers of alcohols or acids are less toxic than the corresponding normal compounds. Aqueous solutions of the free base, nicotine, are considerably more toxic than solutions containing nicotine as sulphate. Amongst

the most toxic of the essential oils are caraway, dill, mustard, marjoram and thyme. Tests with coal-tar fractions show that their toxicities increase with volatility and tar-acid content. Lipoid solvents are exceptionally toxic to *L. cuprina*, and it is considered that they act by dissolving the outermost cuticular layer, thereby facilitating penetration of the cuticle.

Studies on the Physiology and Toxicology of Blowflies.

WATERHOUSE (D. F.). **5. The Hydrogen Ion Concentration in the Alimentary Canal.**—*Pamphl. Coun. sci. Industr. Res. Aust.* no. 102 pp. 3, 5, 7–27, 2 figs., 82 refs., multigraph. Melbourne, 1940.

WATERHOUSE (D. F.). **6. The Absorption and Distribution of Iron.**—*T.c.* pp. 3, 5, 28–50, 2 figs., 24 refs.

LENNOX (F. G.). **7. A Quantitative Examination of the Iron Content of *Lucilia cuprina*.**—*T.c.* pp. 4, 6, 51–67, 1 fig., 55 refs.

In the fifth paper of this series [*cf.* preceding abstract], the results are given of experiments on the hydrogen-ion concentration of the gut contents of the larvae and adults of nine species of Australian sheep blowflies. The main results as regards the larvae have been noticed in a recent abstract [*R.A.E.*, B **29** 52], which, however, requires correction as regards the posterior part of the midgut, which is weakly to distinctly alkaline. The reaction of the gut of the adults is similar, except that the anterior midgut is more acid and the hindgut considerably more acid than in the larva. The other two papers deal with the absorption of iron in the larvae [*loc. cit*] and adults of *Lucilia cuprina*, Wied., and its distribution in them and the pupae, and with the total iron content of eggs, larvae and pupae of this fly.

GUNN (W. R.). **Report of the Live Stock Branch.**—*Rep. Dep. Agric. Brit. Columbia 1939* **34** pp. B68–B77. Victoria, B.C., 1940.

This report includes a brief account of the extension of work carried out for the control of warble-flies [*Hypoderma*] in various districts of British Columbia in 1939. It has now been in progress for six years and has developed very satisfactorily. J. D. Palmer also applied the warble-fly wash, which contains standardised derris, over the shoulders and around the backs of the heads of the cattle to control *Dermacentor andersoni*, Stiles, and in every instance they remained free from ticks. Good results with the same method were reported by stockmen, but the author considers that the dry powder would be safer, particularly in cold weather. Various reports are given of the success obtained with the powder against *D. andersoni* [*cf. R.A.E.*, B **26** 22; **29** 13]. It kept uninfested animals free for 2–4 weeks and sometimes cleared infested animals of ticks, but was not always effective against those that had attached themselves completely. The treatment is definitely effective in the control of *D. albipictus*, Pack., and much more lethal to it than to *D. andersoni*. On all ranges where the treatment has been applied, cattle lice have ceased to give trouble.

ROSE (A. L.). **Leg Mange or "Itchy Heel" of Horses. Description of the Disease and Methods of treating it.**—*Agric. Gaz. N. S. W.* **51** pt. 9 pp. 491–496, 7 figs. Sydney, 1940.

Leg mange of horses, caused by *Chorioptes* (*Symbiotes*) *equi*, Gerl., occurs throughout New South Wales. The mites are picked up by close contact with infested horses or premises. The females lay 20–40 eggs in the wrinkles of the skin about the heels, and under warm conditions, these hatch in 3 days, and the young mites burrow under the surface layers of the skin, causing reddening and intense irritation. They reach sexual maturity in 6 days, and the adult stage lasts about 14 days. In the early stages of infestation, which is confined to the lower part of the hind legs, small nodules appear on the reddening skin, and these change to vesicles and pustules, which rupture and cause dampness. The saliva exuded by the mites seems to have the power of dissolving the surface skin cells, upon which they feed. This moisture and cell débris become caked with dust and scurf, and dry to form hard crusts, which are later shed as more moisture and cell débris are formed beneath. The irritation causes the horse to stamp heavily or rub the heels against a stump or fence, wearing away the hair, and leaving the heels in a roughened state. Various types of damage to the bone and hoof may result from the continuous and heavy stamping of the affected limbs. The mites are most active when conditions are warm and moist. An infested horse rarely becomes free from mites without treatment, which may be effected by hand or by means of dips. If hand treatment is used, the hair should be clipped from the affected area, and the dressing applied at a temperature as high as the animal can comfortably bear; a second application should be made after about a week. One of the most effective dressings consists of sulphur and lard (1 : 4) evenly worked together. Dipping is more effective and simpler than hand dressing and has the advantage that all the horses on a farm can be treated at the same time with the object of eradicating the mange. While they are being treated, stables, posts, etc., should be sprayed with the dipping fluid or a carbolic disinfectant such as 2 per cent. lysol. The bath should be filled to a depth of 2 ft. 9 ins. and the horses kept in it for from 5 to 10 minutes, according to type, heavy draught horses with a lot of hair requiring the full time. Lime-sulphur is the most effective dip against any type of mange in horses. To prepare it, 12 lb. lime is slaked, made into a paste with 30 lb. sulphur, placed in a cloth and boiled in 15 gals. water for 2 hours. The residue is discarded and the fluid made up to 100 gals. for use. Carbolic dips are less effective and more costly.

FOSTER (A. O.) & JOHNSON (C. M.). **A preliminary Note on the Identity, Life-cycle and Pathogenicity of an important Nematode Parasite of captive Monkeys.**—*Amer. J. trop. Med.* **19** no. 3 pp. 265–272, 3 pls., 5 refs. Baltimore, Md., 1939.

A number of *Cebus* monkeys in animal houses of a laboratory in Panama died as a result of infestation by a Nematode identified as *Protospirura muricola*, Gedoelst, and other monkeys were less severely infested. Infective larvae of this Nematode were found in nymphs and adults of *Leucophaea maderae*, F., one of the six species of cockroach occurring in the houses, but not in the other five species. None was found in cockroaches elsewhere. The rate of infestation in *L. maderae*

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was very high, about 96 per cent. in the adults, which were more often infested than the nymphs, and there were several hundred cysts in many of them. Cockroaches were a favourite food of the *Cebus* monkeys.

STEWART (J. L.). **Disease Control.**—*Rep. Dep. Anim. Hlth Gold Cst 1939–40* pp. 2–4. Accra, 1940.

In the section of this report that deals with disease eradication in the Gold Coast in 1939–40, it is stated that the incidence of trypanosomiasis in cattle was much above normal in 1939 on account of the irregular and excessive rainfall, which caused much flooding and resulted in tsetse flies [*Glossina*] being driven further afield than usual.

BEQUAERT (J. C.). **Notes on the Arthropoda of Medical Importance in Guatemala.**—*Publ. Carneg. Instn* no. 499 pp. 223–228, 9 refs. Washington, D.C., 1938. [Recd. 1941.]

This paper comprises records of various insects, mites and ticks collected in Guatemala in the course of an expedition for the study of onchocercosis [*R.A.E.*, B **23** 172]. A list is given of the ticks, none of which was taken on man. The only mites recorded are unidentified Trombidiid larvae that attack man severely in the moist hot, tropical lowlands but cause little trouble in the temperate, coffee-growing zone of the Pacific slope. The bulk of the information on insects is concerned with mosquitos, particularly *Anopheles* and malaria [*cf.* **20** 269; **24** 291].

Other insects troublesome to man include *Cimex hemiptera*, F., an unidentified species of *Triatoma*, *Dermatobia hominis*, Say (*cyaniventris*, Macq.), and the fleas, *Pulex irritans*, L., and *Tunga* (*Dermatophilus*) *penetrans*, L. Body and head lice [*Pediculus humanus*, L., and *P. h. capitis*, DeG.] are of considerable importance in the country, since they are the usual carriers of exanthematic typhus. Dermatitis is caused by *Paederus signaticornis*, Sharp [**20** 186] and *P. laetus*, Erichson.

BEQUAERT (J. C.). **The Distribution of *Phlebotomus* in Central and South America.**—*Publ. Carneg. Instn* no. 499 pp. 229–235, 9 refs. Washington, D.C., 1938. [Recd. 1941.]

A list is given of 40 species of *Phlebotomus* described from Central and South America showing the countries from which they were described and others in which they occur. Annotated records arranged by countries are also given; they include two identified species from Mexico, one from Guatemala, three from Panama, eight from Venezuela, two from Trinidad, one from Dutch Guiana, 22 from Brazil, two from Uruguay, one from Paraguay, five from Argentina, two from Bolivia, and seven from Peru, as well as unidentified species from Honduras, Colombia and Martinique.

SNIPES (B. T.), CARVALHO (J. C. M.) & TAUBER (O. E.). **Biological Studies of *Ornithocoris toledoi* Pinto, the Brazilian Chicken Bedbug.**—*Iowa St. Coll. J. Sci.* **15** no. 1 pp. 27–36, 1 pl., 3 figs., 3 refs. Ames, Iowa, 1940.

An account is given of field and laboratory observations on the life-history of the Cimicid, *Ornithocoris toledoi*, Pinto [*cf. R.A.E.*, B **18** 20], all stages of which are described and which is a serious pest of domestic fowls in two widely separated localities in Brazil, one in

São Paulo and the other in Minas Geraes. Infestation by it results in considerable decrease in egg-production and an apparently increased susceptibility to disease. Nymphs and adults were found in fowl houses and the immediate vicinity of other places where fowls were allowed to roost. They remain hidden in cracks or other shelter during the day and emerge to feed only during darkness.

The technique of breeding the bugs is described. The adults paired within a few minutes of feeding, and oviposition began 5–8 days later. The eggs were laid in groups of 2–4, preferably in cracks and crannies in boards, etc. Females usually oviposited during four distinct periods of 24–36 hours, at intervals of about 8 days, and fed immediately after oviposition. The number of eggs laid during each period was 8–14 and the total numbers produced averaged 46 and ranged up to 74. The feeding periods, without which normal oviposition does not occur, lasted 6–12 minutes. The eggs hatched in 5–10 days at a temperature and relative humidity similar to those in the fowl houses (about 20·5°C. [68·9°F.] and 80 per cent.). The young nymphs crawl to shelter and remain there until ready for their first meal; under natural conditions, feeding did not take place until 20–28 hours after hatching. The nymphal stage was completed in an average period of 34 days, but the durations of all the five instars varied considerably. The nymphs engorged once or twice in each of the first two instars, and two or three times in the third, fourth and fifth. Adults lived for 3–9 months. In the laboratory, both nymphs and adults fed on turkeys, ducks and, less readily, pigeons, but showed a marked preference for fowls. This bug does not attack man [*cf.* **27** 244].

Bruce (W. G.). **The Horn Fly and its Control.**—*Leafl. U. S. Dep. Agric.* no. 205, 5 pp., 3 figs., 1 ref. Washington, D.C., 1940.

Brief notes are given on the habits, seasonal activity in Texas and life-history [*R.A.E.*, B **16** 134] of *Lyperosia* (*Haematobia*) *irritans*, L., an important pest of cattle occurring throughout the United States and in all the Provinces of Canada. In addition to the direct injury caused by annoyance, infestation renders the cattle susceptible to attack by screwworms [*Cochliomyia hominivorax*, Coq.]. Suggested methods of control include the spreading of droppings, which is feasible only for small pastures, destroying the flies on cattle by regular applications of a spray of pyrethrum extract in oil [**28** 240], and the use of traps [**26** 248] and of splashboards on the vats in which the cattle are dipped for the control of other pests. These boards which are about a foot wide, are placed along the sides of the vat about 4 ft. above the surface of the dipping solution at such an angle as to cause the solution to break over the backs of the animals as they plunge into it and catch the flies as they rise and carry them down into the solution. Internal medication, which is still in the experimental stage [**28** 208], and the use of repellents [**16** 134; **23** 168] are not recommended.

Cornell (V. H.) & Davis (W. A.). **Mosquito Transmission Experiment with Poliomyelitis Virus.**—*Proc. Soc. exp. Biol.* **42** no. 1 pp. 78–80, 1 ref. New York, N.Y., 1939. [Recd. 1941.]

Details are given of an unsuccessful attempt, made in 1939, to obtain transmission of the virus of acute anterior poliomyelitis

(infantile paralysis) by mosquitos [*cf.* *R.A.E.*, B **6** 171; **10** 54; **22** 71]. It is pointed out that a defect of the method used, which consisted in allowing a batch of females of *Aëdes aegypti*, L., and *Culex pipiens*, L., to feed at various dates on an artificially infected monkey (*Macacus rhesus*) and later on a healthy one, was that it was impossible to determine how many individuals of *A. aegypti* fed on both animals, and whether any of *C. pipiens* did so. Of about 100 females of *A. aegypti*, 46–47 fed on the infected monkey and 89–93 fed on the normal monkey 5–28 days later. The corresponding figures for *C. pipiens* were 75, 16–18 and 38–41. A filtered suspension of the mosquitos that were alive at the end of the experiment (48 *Culex* and 56 *Aëdes*) was inoculated intracerebrally into another monkey. Neither of these two monkeys developed any symptoms of poliomyelitis in the 3 weeks of observation.

BUGHER (J. C.). **A Micromortar especially adapted to Virus Studies in Insects.**—*Proc. Soc. exp. Biol.* **43** no. 2 pp. 422–424, 1 fig. New York, N.Y., 1939. [Recd. 1941.]

A description is given of a pestle and mortar made of pyrex glass and designed to triturate insects with the minimum loss of material.

WATSON (G. I.). **A physiological Study of Mosquito Larvae which were treated with anti-malarial Oils.**—*Bull. ent. Res.* **31** pt. 4 pp. 319–330, 5 refs. London, 1941.

The following is based on the author's discussion of this paper, which is extracted from a thesis and records work designed to elucidate the reasons why mosquito larvae die when in contact with oils. The research showed not only that a larva, after contact with an oil, may die from several causes, but also that in certain circumstances it may survive oiling if it is able to moult. A table is given showing the many physiological functions of a larva that may be disturbed by the action of an oil, and the possible result. Certain oils are directly poisonous to a larva, causing convulsions and then paralysis. All the poisons examined were found to be soluble in water and able to penetrate the outer cuticle of the larva. The process of refining kerosenes for use as smokeless fuel is shown to remove from them at least some of the substances that make untreated kerosenes highly toxic to anopheles larvae.

The ability of oil to enter the tracheal tubes of a mosquito larva is discussed in the light of observations that the oil/air meniscus in the tracheae of living larvae partly filled with certain oils is convex towards the air, showing that there must be some force either pushing or sucking the oil in. It is suggested that when an oil film blocks for a moment the tracheal spiracles of a larva, the removal of oxygen by respiration from the intra-tracheal air is sufficiently fast to lower the gas pressure within the tracheae, causing some oil to be sucked in. It is thought that water fails to enter the tracheae on account of the instability of a film of water in the region of the spiracles. Oil is often seen to enter the tracheae as a direct result of the larva smearing a film of oil over the spiracles, in an attempt to remove an irritant from that region. If the oil is not irritant, no film is smeared over the spiracles and oil may not enter the tracheae until much later. No larva, either Culicine or Anopheline, in which both tracheae were

quite full of any oil was seen to moult or pupate. The presence of oil in one trachea only did not always prevent the larva from moulting, and the tracheae in the next instar always contained air only, but oil even in the tips only of both tracheae seriously interfered with moulting, and the larva usually died. Oil in one or both tracheae appears to obstruct the process of pupating more than that of moulting. The heart may be paralysed by poisons present in certain oils. All of a variety of micro-organisms on which the larvae feed were killed by contact with certain oil films or emulsions, yet they could live and multiply under complete surface films of other oils. The oils that killed the micro-organisms were those that poisoned the larvae. A table of experimental results is given showing that a difference in the width of the initial spread of two oils on water represents a difference in the chances of a larva in the water being oiled. It is suggested that the flaps over the tracheal openings are normally held closed by a relatively weak spring which is easily overcome by the tension forces at the surface of the water and also, apparently, by the weaker forces at the interface between an oil and water. This oil/water interfacial tension may be so small in an oil that spreads very widely on water that the tracheal flaps are not pulled open by it.

Toxic oil may, with advantage, be applied in very small quantities as an emulsion on shallow stretches of standing water, as there the poisons, being water-soluble, have a chance of acting on the larvae, their food supply and their vegetable shelters for a considerable time. The fact that longer is required for an oil to enter the tracheae as an emulsion than as a surface film and that the exposure of an anopheles larva, even for half an hour, to toxic emulsions at field strength is not always sufficient to prevent it from moulting make emulsions less suitable for use in running water.

JACK (R. W.). **Notes on the Behaviour of** *Glossina pallidipes* **and** *G. brevipalpis*, **and some Comparisons with** *G. morsitans*.—*Bull. ent. Res.* **31** pt. 4 pp. 407–430, 7 figs., 9 refs. London, 1941.

The following is taken from the author's summary of this paper on the behaviour of *Glossina pallidipes*, Aust., and *G. brevipalpis*, Newst., in the part of Mozambique from which these flies invade the southern Melsetter district in Southern Rhodesia [*R.A.E.*, B **28** 50, etc.]. The observations were mostly made between June and September 1939, and a low mean fat-content in the flies was taken to indicate hunger. Both species fill themselves readily with human blood once an attack has been made, but neither sex of either species attacks man unless very hungry, *G. brevipalpis* being apparently even more reluctant to do so than *G. pallidipes*. Females of both species and males of *G. pallidipes* are not attracted to a donkey unless hungry, but males of *G. brevipalpis* are apparently attracted whether hungry or not. Both species are very weakly attacted to a moving motor vehicle compared with *G. morsitans*, Westw. [*cf.* **28** 23]. Males of both species may be so attracted when moderately fat, but the position in regard to the females is uncertain. A grey blanket screen carried between two natives attracted *G. pallidipes* moderately and *G. brevipalpis* poorly. The mean weight of fat in males of the former species caught on the screen was rather lower than in those caught on a donkey, but the mean weight of fat in females was the same in respect of both attractants. Traps more or less of the Harris type [**19** 78], but frequently

with black cloth in place of hessian [**28** 25], caught a large number of *G. pallidipes*, of which 61·2 per cent. were females, but very few of *G. brevipalpis*. The mean fat content of trapped males of *G. pallidipes* was low, while that of the females was much higher than in the case of females caught by any other attractant. Of the females of this species taken in traps and on a donkey, 14·5 and 2·4 per cent., respectively, were in advanced pregnancy. *G. pallidipes* appeared usually to enter the traps between 4 and 5.30 p.m., but this depended upon the weather. Traps that received the rays of the sun in late afternoon were among the most effective.

Comparative tables show the dry weight, weight of fat and stage of pregnancy in groups of *G. pallidipes* caught by means of different attractants. The capture on a host of a considerable proportion of females containing advanced larvae indicates insufficient opportunity of feeding in the locality. Methods of estimating the state of hunger at the time of death in the case of dry tsetse flies are discussed. Tables are given indicating the respective responses of *G. morsitans*, *G. pallidipes* and *G. brevipalpis* of both sexes to various attractants, and also the proportion of the sexes in normal catches on these attractants. No satisfactory attractant has been found for males of *G. pallidipes* that are not hungry. There are consistent differences in the proportions of the mean weight of fat in the sexes in catches of the different species on different attractants. If the female fat is expressed as a percentage of the male fat, the lowest figure refers to *G. morsitans* caught on man, and the highest to *G. pallidipes* caught in traps. In the case of both these species, the traps caught only lean males, including some young ones ; females in all stages of nourishment were taken, though young females seemed to be inadequately represented in the catches. Figures obtained with *G. morsitans* indicated that the failure of the fat males and young females to be caught was due to failure to enter the traps rather than failure to be attracted to the outside. Under humid conditions relatively few lean females of *G. pallidipes* of any age were caught in traps, whereas under hot, dry conditions old lean females of *G. morsitans* were caught in considerable numbers. The alimentary condition of *G. pallidipes* caught in the traps supported the view that hunger is not the primary stimulus leading to the attraction and capture of flies. The fact that the traps catch flies only within a certain range of alimentary condition reduces their value as a barrier against fly movements. The capture of well-nourished heavily pregnant females in traps erected in the open shows that such females move about relatively freely. A cheap form of trap is described, and some notes on trapping results are included.

MULES (M. W.). **Notes on the Life History and artificial Breeding of the Australian " Stickfast " Flea,** *Echidnophaga myrmecobii* **Rothschild.** —*Aust. J. exp. Biol. med. Sci.* **18** pt. 4 pp. 385–390, 3 figs., 2 refs. Adelaide, 1940.

The purpose of the work described in this paper was to develop methods for breeding and handling Australian fleas of the genus *Echidnophaga* in the laboratory with a view to determining their capacity to act as vectors of virus myxomatosum, a specific pathogen for the European rabbit. In March 1939, many wild rabbits on Yorke Peninsula, South Australia, were found to be heavily parasitised by *Echidnophaga*, and a consignment found to consist of *E. myrmecobii*,

Roths., and *E. perilis*, Jordan, the former greatly predominating, was sent to Canberra for breeding experiments. *E. perilis*, however, died out in the laboratory after two generations.

The following is based on the author's summary of the work with *E. myrmecobii*. The life-history is described, and details are given of the technique and apparatus used in rearing. It was found that the natural food of the larvae was faeces of adult fleas. Dried ox or rabbit blood mixed in sand was a suitable medium for the cultivation of the larvae. The optimum temperature for the immature stages was 22°C. [71·6°F.], and oviposition was stimulated during cold weather by raising the temperature of the room to this level. Descriptions are given of special cages by means of which eggs and faeces of the flea, uncontaminated by the excreta of the host, can be collected, a trap in which adult fleas may be collected as they emerge, a flea-proof cage for housing laboratory rabbits, and methods used to separate flea eggs from foreign material and to collect cocoons from the medium. Rabbits and rats were parasitised by artificial methods.

SAPRE (S. N.). **The Life-history of** *Boophilus australis* **(Fuller).**— *Indian J. vet. Sci.* **10** pt. 4 pp. 346–353, 2 refs. Delhi, 1940.

Laboratory and field observations on the life-history of *Boophilus annulatus microplus*, Can. (*australis*, Fuller) were carried out in 1937 and 1938 at Mukteswar [United Provinces]. It had been intended to work out the life-histories of the commonest Indian ticks under ordinary Indian field conditions, but as this study had to be made at Mukteswar, which is at an altitude of 7,500 ft., the observations may not apply to the conditions obtaining in the plains. Normally no other species of tick infests cattle in the locality where the experiments were carried out. *B. a. microplus* completes two generations in a year. The first generation, which hatches from overwintered eggs in April and matures about the end of June, is small, probably because few of the eggs survive the hard winter and the humidity in early summer is too low to be favourable to the ticks. Eggs of the next generation hatch by the middle or end of July, and the ticks become adult during October and November. Oviposition may extend over 1½ months. For the laboratory studies, 60 engorged females were kept in an incubator at 22°C. [71·6°F.] with a glass of water to provide the necessary humidity. Individual ticks were kept in tubes with strips of filter paper to provide a hiding place and darkness. The method by which the number of eggs laid by individual ticks was estimated is outlined. The average durations of the pre-oviposition, oviposition, and post-oviposition periods and the egg stage, reckoned from the beginning of oviposition to the hatching of the first larva, were 4, 18, 4 and 39 days, and the average number of eggs laid was 2,552.

When liberated on the body of an ox, the larvae scattered and most of them were attached within 10 minutes. They showed a preference for the skin of the neck, dewlap and escutcheon. The nymphs and adults fed near the site they had occupied as larvae, and feeding began immediately after each moult. Feeding and metamorphosis lasted 3 and 4 days, respectively, in the larval stage and 4 and 3–5 days in the nymphal stage. The males, which were fewer and smaller than the females, fed for 1–2 days before pairing. The fertilised females increased noticeably in size and fed vigorously from the sixth day after the moult and on the ninth to eleventh day

dropped off to oviposit. Unfertilised females did not attain half the size of the fertilised ones and usually did not lay eggs. The results of observations on the duration of the parasitic stages and periods of metamorphoses, made with two batches of ticks, one fed by means of ear bags and the other applied to the skin under the tail, are summarised in tables.

KAPUR (H. R.). **Transmission of Fowl Spirochaetosis through Agents other than** *Argas persicus*.—*Indian J. vet. Sci.* **10** pt. 4 pp. 354–360, 14 refs. Delhi, 1940.

The literature on the transmission of fowl spirochaetosis [*Spirochaeta anserina*], which is prevalent throughout India, is briefly reviewed, and an account is given of experiments made to determine whether it can be transmitted by mosquitos [*cf. R.A.E.*, B **25** 5; **28** 236] or by ticks other than *Argas persicus*, Oken. The species tested were *Ornithodorus tholozani*, Lab. & Mégn. (*papillipes*, Bir.), *O. savignyi*, Aud., and *Aëdes albopictus*, Skuse. The ticks were fed on infected fowls in the third nymphal instar and on healthy fowls in the fourth or fifth. All the experiments with both species of *Ornithodorus* and the mosquito, which fed readily on the fowls, were negative, whereas control experiments with *Argas persicus* gave positive results, and the healthy fowls used in the negative tests were subsequently shown to be susceptible to infection. It was also shown that the disease could be transmitted to healthy fowls by smearing infective material on the unbroken skin of the comb or breast, the incubation period in such cases being 2–6 days.

RUSSELL (P. F.), KNIPE (F. W.) & RAMACHANDRA RAO (T.). **On using Water instead of Dust for diluting Paris Green in Malaria Control.**—*Indian med. Gaz.* **75** no. 12 pp. 740–742, 1 fig., 2 refs. Calcutta, 1940.

A dustless method of diluting Paris green for anopheles control, based with modifications on one already noticed [*R.A.E.*, B **24** 289], has been successfully used for two years in Pattukkottai taluk [Madras Presidency]. A stock suspension is prepared by putting 400 cc. kerosene oil, 200 cc. Paris green and 1 gm. powdered egg albumin, in the order given, into a Winchester bottle and thoroughly shaking it, and 25 cc. is then poured into each of a number of glass vials. Two litres of water from the breeding place are poured into the tank of a Hudson Sterling no. 115 sprayer, through a funnel with a wire gauze sieve, and, after vigorous shaking, the contents of one vial of the suspension, 20–25 of which are carried on a belt of the cartridge belt type, and a further 3 litres of water are added. The operator then pumps to the desired pressure, slings the sprayer on his back and sprays with the nozzle 1–1½ ft. from the surface of the water. The contents of one vial ordinarily suffice for 700–900 sq. ft., and an average workman used 20–25 vials in a day. Spraying branch irrigation canals, irrigation channels, the edges of reservoirs, borrow pits and wells at intervals of 4–5 days from 15th July to 5th November 1938 and thereafter at intervals of seven days until 5th December, and field channels and ditches at similar intervals from 7th August till 25th December 1939, effectively controlled breeding of *Anopheles culicifacies*, Giles, in the places sprayed, sometimes in the presence of considerable vegetation. It is

estimated that the width of the sprayed area along a canal bank was 1 ft. About 969 sq. ft. were covered per vial in 1938 and 691 sq. ft. in 1939. Several tests of the method were made, all with excellent results. The initial and recurrent expenses are given, and it is concluded that the method is effective, simple and cheap.

McCay (F.) & Senior White (R.). **Biological Control of Culicine Mosquitoes by Prawns in a Bengal Coal Mine.**—*Indian med. Gaz.* **76** no. 1 pp. 37–38. Calcutta, 1941.

In January 1939, Culicine mosquitos were discovered breeding prolifically in small, shallow pools about 1,000 ft. underground in some of the galleries of a coal mine about 130 miles from Calcutta. They had probably been sucked into the mine in the main air draught. A constant temperature of about 90°F. and a relative humidity of 80 per cent. throughout the year provided ideal breeding conditions, and a plentiful supply of human blood was always available, as two 12-hour shifts were worked daily. Some of the pools also contained small prawns (*Palaemon lamarrei*, M.-E.) that had apparently been introduced in the moist sand used for stowing, and in these pools the mosquito larvae and pupae were less numerous. Observations in the laboratory showed that a prawn could consume, on an average, nearly three larvae of *Culex fatigans*, Wied., per day. On a later visit to the mine it was found that the prawns had apparently cleared the section where breeding had first been noticed, though conditions had remained unaltered, but mosquitos were present in other sections where there were no prawns. Some were introduced, but both prawns and mosquitos were adversely affected by the constant disturbance of the pools by the work of the miners. The authors have not heard of Anophelines breeding below ground, but they are common on the surface near the mine, and a considerable amount of malaria occurs. It is thought that the prawns can do much to improve conditions for the miners and may, to a limited extent, contribute to the surface control of malaria.

Herms (W. B.) & Gray (H. F.). **Mosquito Control. Practical Methods for Abatement of Disease Vectors and Pests.**—Sup. roy. 8vo, xii+317 pp., 60 figs. (25 pls.), many refs. London, Humphrey Milford, Oxf. Univ. Pr., 1940. Price £1.

This book on the principles and methods of mosquito control is a practical one designed primarily for those actually engaged in such work. It deals chiefly with conditions in the United States, but also includes information obtained from, or applicable to, other parts of the world. After an introduction on the historical aspect, the classification of mosquitos, and general principles for their control and for the prevention of the diseases they carry, the economic importance of mosquitos and malaria is discussed at some length, and an account is given of laws operating in various parts of the United States for their abatement and the organisations concerned. The entire procedure of control, starting from the making of the preliminary survey and report, the selection of personnel, the practical preparations and the location of the breeding places, is then reviewed. Under the heading of general principles, effectiveness and economy, adaptation of abatement measures to certain species according to their habits, equipment and

labour, and wild-life conservation are discussed. The succeeding chapters contain a detailed analysis of the treatment of various types of terrain: draining and reclaiming fresh-water and salt-water marshes, filling marshes, holes and ponds, pumping, flushing small streams, applying oils and larvicides and introducing larvivorous fish. Supplementary protective measures, such as using screens, bed nets and repellents, killing adult mosquitos and diverting them to animals are also discussed. Further chapters deal with the special problems of control under urban, rural and military conditions, and also with the problem of restricting the spread of disease-infected mosquitos by aeroplanes. The final chapter is concerned with the adaptation of measures for species sanitation, with special reference to experience gained in California and in the central and southern States, and for naturalistic control. Emphasis is placed upon securing and maintaining public interest and support for mosquito control work and upon economy and effectiveness to justify this support.

The bibliography is intended to be representative rather than exhaustive, as it is felt that reference to works not easily accessible would serve no useful purpose, but appropriate publications are cited at the end of some of the chapters and a geographically arranged list of the more important texts and monographs is given in an appendix. Other appendices include a list of the principal malaria-transmitting Anophelines of the world, arranged geographically and showing the region where they are of importance as vectors and their typical breeding places, and a classification of abatement methods against larvae and adults.

A brief Review of needed Research in Malaria.—*Publ. Hlth Rep.* **55** no. 40 pp. 1801–1809. Washington, D.C., 1940.

A brief outline is given of the subjects of research that might increase the efficiency of malaria control; they include various problems relating to the malaria parasite and the bionomics and ecology of Anophelines. As an example of the effectiveness of measures based on a knowledge of the habits of the species concerned, it is stated that the index of *Anopheles gambiae*, Giles, in a section of northern Brazil was reduced to zero in about 10 weeks by weekly sprayings of the interior of dwelling houses, which had been found to be its only daytime resting-place [*cf. R.A.E.*, B **28** 194–5].

Edwards (F. W.). **Mosquitoes of the Ethiopian Region. III.—Culicine Adults and Pupae.**—Sup. roy. 8vo, viii+499 pp., 4 col. pls., 184 figs., 6 pp. refs. London, Brit. Mus. (N. H.), 1941. Price £1 10*s*.

This posthumous volume completes the monograph on the "Mosquitoes of the Ethiopian Region" publication of which was begun in 1936 [*R.A.E.*, B **24** 123; **26** 182]. The term Culicine is taken to include the members of the tribes Culicini and Megarhinini (genus *Megarhinus*). The two main sections comprise descriptions of the adults (pp. 6–353) and pupae (pp. 354–428) of the genera and species of Culicines of the Ethiopian Region [Africa south of the Sahara, together with Madagascar and the Mascarene Islands and south-west Arabia], with notes on the distribution of each, some 290 species and 40 named subspecies and varieties being dealt with. Each of these sections is preceded by an account of the characters used in classification, and the technique of preparing the adults is described. Keys

are given to the adults of the genera of CULICINI, the subgenera of *Aëdes* and *Culex* and the species of each genus or subgenus comprising more than two or three members, and to the pupae of the different genera.

In the introduction, the present state of knowledge with regard to the transmission of diseases of man and domestic animals by members of the tribe CULICINI in tropical and southern Africa is very briefly summarised. A number of corrections and additions to the two previous parts are appended, and there is a final section on the zoogeography of all the Ethiopian mosquitos, with a complete list of the species, subspecies and varieties, showing their distribution in the various parts of the region.

Yellow Fever and East Africa.—*E. Afr. med. J.* **17** no. 10 pp. 403–408. Nairobi, 1941.

Early in October 1940, an outbreak of yellow fever occurred in a remote part of the Nuba Mountains District of the southern Sudan. Over 15,000 cases with more than 1,600 deaths were reported from an area some 6,000 sq. miles in extent. In January 1941, the epidemic was rapidly dying down. It is not known whether *Aëdes aegypti*, L., is sufficiently abundant in the Nuba Mountains District to have been the only or the chief vector. During the past decade, evidence was collected indicating that outbreaks of yellow fever had occurred within the present generation in many parts of central Africa where cases had never been clinically diagnosed and also in the southern Sudan as far east as the Abyssinian border and in some areas in the west of Uganda [*R.A.E.*, B **24** 296]. However, no case clinically recognisable as yellow fever had previously been found in the Sudan. The circumstances in which the epidemic occurred almost certainly preclude the possibility that the infection had recently been introduced from the west. This is taken as an indication that infection is probably present in some form in every region where mouse-protection tests have yielded positive results and that epidemics may occur in any of these places at any time.

In view of the considerable extent and speed of travel in Africa in modern times and the abundance of *A. aegypti* on the east coast, the situation is regarded as serious, and a conference of representatives from eastern and east-central African countries and the Union of South Africa was held at Nairobi in December. It was decided that it was a matter of paramount importance to eliminate *A. aegypti* from all seaports on the East African coast that have international or intercolonial trade, all ships trading on the coast or plying on Lakes Victoria and Tanganyika, all inland urban centres and aerodromes, and all railway premises and stopping places and their neighbourhood.

Experience in South America is considered to show that, even if the yellow fever in the Nuba Mountains District were of the jungle type and not transmitted by *A. aegypti*, its spread to urban areas would be prevented by the control of this mosquito in them [*cf.* **28** 171].

VANDERPLANK (F. L.). *Nothobranchius* **and** *Barbus* **Species : indigenous anti-malarial Fish in East Africa.**—*E. Afr. med. J.* **17** no. 10 pp. 431–436, 3 figs., 1 ref. Nairobi, 1941.

Nothobranchius and *Barbus* are considered superior to *Gambusia* for the control of mosquito larvae in East Africa [*cf. R.A.E.*, B **28** 158]

in that they are indigenous and widely distributed and the former at least is able to resist drought by depositing resistant eggs. Notes are given on their habits and the life-history of *Nothobranchius*. *Pachypanchax playfairi*, probably the most important of the other species native to East Africa that prefer mosquito larvae to other food, has not yet been studied by the author in its natural habitat.

SYMES (C. B.). **Malaria in Nairobi.**—*E. Afr. med. J.* **17** nos. 8, 9, 10 & 11 pp. 291–307, 332–355, 414–430, 445–463, 2 fldg. graphs, 6 refs. Nairobi, 1940–41.

This paper is based upon data obtained during routine mosquito surveys made in Nairobi during the period 1926–37. Information is given on the town and its climate, the inhabitants and their occupations, and the death rate, number of deaths from malaria and infant mortality. The history of malaria in Nairobi from 1907 until 1936 is briefly reviewed, the present position, which is considered most unsatisfactory, is described, and the cost of malaria to the community discussed. Some 900 cases of malaria with 35–40 deaths occur annually, mostly among the African and Asiatic population. There does not appear to have been any appreciable decline during the past 10 years. Most of the infections are due to subtertian malaria [*Plasmodium falciparum*].

The technique used in making the mosquito surveys is described, and a list is given of 17 species of *Anopheles* now known to occur in Nairobi, 6 of which are recorded from the town for the first time, with notes on the breeding-places of most of them. *A. gambiae*, Giles, was the only species found infected in nature, its highest average sporozoite rate for any particular month over the years 1926–38 being 1·0 per cent. in April and November. *A. funestus*, Giles, which is a vector in many parts of Kenya, has almost disappeared from Nairobi, where it appears to be unable to establish itself, and is very seldom found in dwellings. Breeding places of *A. gambiae* are usually more numerous than those of other species, on account of the abundance of stagnant or nearly stagnant water. Most of the stagnation is man-made. The most persistent and intense production of *A. gambiae* occurs in the Nairobi swamp, a market garden area covering about $1\frac{3}{4}$ sq. miles and irrigated by two main canals and a network of smaller ones. During the period under review this area produced more *A. gambiae* at all seasons than the remainder of the municipal area, which occupies 36 sq. miles, and from 1931 onwards about 75 per cent. of the infected females were taken in dwellings on or around it. Adults of *A. gambiae* constituted more than 90 per cent. of all anopheles in dwellings, and their seasonal increases coincide closely with increases in malaria. A search of harbourage other than dwellings indicated that they rest in large numbers in long grass and bush. Breeding is continuous and the average duration of the life-cycle is 18 days.

Legal powers for eradicating mosquitos have existed since 1911, but they are inadequately used. It is suggested that the requirements for successful control are a special adequately trained staff, the early and complete eradication of all permanent breeding grounds of *A. gambiae*, effective temporary measures to control breeding until permanent ones render them unnecessary, the enforcement of legal measures already provided, effective propaganda, a study of infection in the population by parasite and spleen surveys, and the

investigation of the sources of infection of all reported cases. A programme is given for the abolition of breeding places of *A. gambiae*, including the complete prohibition of irrigation and market gardening in the Nairobi swamp. Many hundreds of tests of oils available in East Africa have led to the conclusion that the most effective mixture is one of 10 parts Persian fuel and 1 part solar (or gas) oil. Borneo fuel oil gave slightly better results but is no longer available.

BUXTON (P. A.). **Discussion on Prevention and Treatment of Parasitic Diseases. Some Recent Work on the Louse.**—*Proc. R. Soc. Med.* **34** pp. 193–195. London, 1941.

The importance of the population of the vector in the incidence of insect-borne diseases is pointed out, and, as an example, the decline of typhus in England and Wales is outlined from 1880, up to which date about 1,000 fatal cases occurred annually, until 1918, when the last one was recorded, although lice [*Pediculus humanus*, L.] have not been eradicated. The author's studies on populations of head lice [*P. h. capitis*, DeG.] as occurring in various parts of the world [*R.A.E.*, B **24** 97; **26** 116; **28** 234] are reviewed. The abundance of the head louse among the school-children in cities in England [**29** 99] and its rarity among adults is taken as an indication that there is some difference in resistance to the parasite, resistance increasing as the host grows older [*cf.* also **26** 116]. The large proportion of infested persons in all the places studied who have only 1–10 lice in the hair [**28** 234] is commented on, and it is suggested that brushing and combing the hair, though not adequate to control the infestation, keep it permanently at a low level. In conclusion, reference is made to a powder [see next abstract] and a liquid insecticide that have recently been found to be effective when applied in garments for the control of body lice. The formulae for these preparations are secret. A small quantity of the liquid renders a shirt louse-proof for about a month.

BUXTON (P. A.). **The Control of Lice.**—*Brit. med. J.* 1940 **2** no. 4165 pp. 603–604, 2 refs. London, 1940.

In view of the danger that outbreaks of body and head lice [*Pediculus humanus*, L., and race *capitis*, DeG.] may occur in Britain as a result of the crowding together of the population at night in shelters, the biology and incidence of lice are briefly reviewed. At the temperature that prevails on the surface of the body (about 86°F.), the egg, larval and adult stages last about 9, 9 and 30 days, respectively. One female lays 8–10 eggs per day, so that the female offspring of a louse might number 120 in the first generation and 14,400 in the second. In England, in peacetime, a large proportion of the school-children have head lice [*R.A.E.*, B **29** 99], but the body louse is difficult to find except among the destitute.

General principles are laid down for control, and various formulae for use against head lice are given. For the control of body lice insecticidal powders may prove to be of great value. N.C.I. (96 per cent. naphthalene, 2 per cent. creosote and 2 per cent. iodoform), which was used extensively in the war of 1914–18 [**4** 133] is effective but causes dermatitis on some individuals. H. J. Craufurd-Benson and J. Macleod have recently produced two formulae, AL. 16 and AL. 63 [*cf.* preceding abstract], both of which are very effective and remain so for

about a week in treated garments that are being worn. About 1 oz. suffices for shirt and pants, the powder being rubbed particularly into seams. AL. 63, which contains an additional constituent, is more rapid in action than AL. 16, but has a characteristic smell. As the powders are unlikely to kill nits, two applications should be made at an interval of a week. The powders appear to be equally suitable for the head. They should be massaged down to the roots of the hair, and the excess brushed off, the eyes being kept shut. The most convenient agent for disinfesting garments, blankets, etc., is heat. Exposure to 129°F. for 5 minutes, or 121°F. for 45 minutes, will kill lice and eggs, whether the heat is dry or moist. Soaking in 2 per cent. cresol for at least an hour at 61°F. or a higher temperature, or ironing with special attention to folds and pleats, is also effective. As the louse cannot survive starvation for long, clothing may be disinfested by storage, provided that enough time is allowed for the eggs to hatch and the newly hatched lice to die. By permission of H. S. Leeson, a table is given showing that at 95, 86 and 75°F. the egg stage lasts 5–7, 9–11 and 17–21 days, and the safe period is 10, 14 and 28 days, respectively. If kept at temperatures below 75°F. the eggs cannot hatch, though they can develop and hatch later if the temperature is raised. The safe period below 75°F. is not defined, but may be taken as a month.

RAU (P.). **The Life History of the American Cockroach,** *Periplaneta americana* **Linn.** (**Orthop. : Blattidae**).—*Ent. News* **51** nos. 5, 6, 7, 8 & 10 pp. 121–124, 151–155, 186–189, 223–227, 273–278, many refs. Philadelphia, Pa., 1940.

The observations on the behaviour of *Periplaneta americana*, L., recorded in this paper were made in Missouri in 1937 and 1938. The cockroaches, both sexes of which can fly, are very active at night but spend the daylight hours gregariously in dark crevices. They are omnivorous. Observations on pairing behaviour, made with the help of a dim flash light, are recorded at some length. The egg-case usually requires more than 24 hours for completion, after which it remains attached to the female for a period varying from a few hours to 4 days. When dropped, it is carefully concealed to prevent its being eaten by other cockroaches. The period of incubation after deposition for 40 egg-cases varied from 38 to 49 days [*cf. R.A.E.*, B **29** 55], and the number of eggs contained in them varied from 6 to 16. There was usually no mortality in the egg stage. The number of egg-cases deposited by 20 females varied from 6 to 14. In 133 instances, the period that elapsed between the dropping of egg-cases by the 20 females varied from 2 to 19 days, except for three exceptional cases in which the periods were 31, 40 and 53 days. In nearly two-thirds of the records, the interval was 2–9 days. The time that 10 females survived after depositing their last egg-case varied from 4 to 65 days. Some adults lived for 12 months after the last moult. In 11 individuals bred in the laboratory, the period from hatching to the last moult varied from $11\frac{1}{2}$ to $14\frac{1}{2}$ months and the total life-cycle from hatching to the death of the adult from $16\frac{1}{2}$ to over 25 months.

In spite of their concealment, which effectively protects them from other cockroaches, two of the egg-cases under observation were parasitised by *Melittobia chalybii*, Ashm., and a third by *Tetrastichus hagenowi*, Ratz., 25 adults of which emerged from it. The adults of

both these Eulophids emerged in October. Keeping the cockroaches in an over-moist environment caused heavy fungous growths to develop on the food supply and was responsible for the appearance of enormous populations of the mites, *Rhizoglyphus tarsalus*, Banks, which sometimes attacked the cockroaches.

Mohler (J. R.). **Report of the Chief of the Bureau of Animal Industry, 19**[39–]**40.**—90 pp. Washington, D.C., U.S. Dep. Agric., 1940.

As a result of the continuation of the campaign for the eradication of *Boophilus annulatus*, Say, on cattle, horses and mules in the United States in 1939–40, the area remaining under Federal quarantine was reduced to 1 per cent. of its original size [*cf. R.A.E.*, B **28** 100]. A table is given showing the progress made since the campaign began in 1906 and the position on 30th June 1940. Tick-infested deer remained the most troublesome aspect of the work in Florida. No infestation has been found for 15 months in the central part of the State from which the removal of deer was authorised in 1937, and satisfactory progress was made in one of the counties from which it was authorised in 1939, but in the other, opposition delayed the work. Reinfestation from stray animals from Mexico continued to occur in the lower Rio Grande Valley of Texas, and the construction of a fence along part of the international boundary is advocated by many. In Porto Rico and the Virgin Islands, where *B. a. microplus*, Can. (*australis*, Fuller) is prevalent, it was also necessary to treat the sheep and goats and a few deer on infested premises. The middle third of Porto Rico, covering 1,247 sq. miles, was released from quarantine.

In the course of studies on possible vectors of anaplasmosis of cattle, adults of *Amblyomma maculatum*, Koch, that had had infective meals as larvae and nymphs, *Stomoxys calcitrans*, L., and *Psorophora columbiae*, D. & K., failed to transmit the disease either from carriers or from animals with clinical anaplasmosis to healthy ones. Continued experiments with washes consisting of 12 or 16 oz. derris or cubé powder and 4 oz. soap in water to make one U.S. gal. scrubbed into the back and sides of cattle at about 1 U.S. pint per animal for the control of *Hypoderma lineatum*, Vill. [**28** 101] showed that derris and cubé were equally effective. Powders containing 4 per cent. rotenone and used at 12 oz. per U.S. gal. were as effective as those containing 5 per cent. used at 16 oz. per U.S. gal. in killing larvae *in situ*, but less so against those that came up after the treatment had been applied. More than one treatment was usually necessary to eradicate the larvae. The treatment caused no injury to the cattle, even when the temperature was as low as 20°F. Three applications of a bentonite-sulphur spray, one before the warble-flies were active and two during the period of activity, failed to prevent infestation. No symptoms of anaphylaxis and little swelling at the point of injection developed in calves into which a preparation made of freshly ground *Hypoderma* larvae was injected before they were exposed to infestation, and the calves developed no immunity. Of dairy cattle examined for demodectic mange [caused by *Demodex bovis*, Stiles] in Colorado, Texas, New Mexico and Illinois, from 15·1 to 24 per cent. were infested. Attempts to transfer the mite by direct contact, brushes and other implements, or the contents of infected nodules all failed. External

applications that failed to control the mange when used as dips or sprays included an arsenical dip, a fused-bentonite-sulphur dip and a saturated solution of borax. Rotenone in oil or in acetone, applied directly to the lesions, and medication of the cattle with such products as dry irradiated yeast, cold-pressed wheat-germ oil and borax, were equally ineffective. Cattle lice were eradicated by a single treatment with derris powder.

Observations on June beetles [*Lachnosterna*] as intermediate hosts of the thorn-headed worm of swine [*Macracanthorhynchus hirudinaceus*] indicated that the adult beetles can harbour about twice as many infective larvae as the grubs [*cf.* **28** 101–102], though the presence of more than 35 such larvae usually results in the death of the beetle after two or three days. The beetles constitute a potential means of dissemination of the parasite and a danger to the pigs that swallow them.

PARMAN (D. C.). **The Development of Research in preventive Entomology.**—*J. econ. Ent.* **33** no. 5 pp. 749–754, 2 figs. Menasha, Wis., 1940.

The author points out that preventing the development of destructive insect populations is preferable to controlling the insects when they have become injurious, and, with the object of stimulating further investigations, describes a logical procedure for research in preventive entomology, suitable for application to extensive areas. This consists in obtaining a census of the population of the insect in question, determining what climatic, host, disseminative, biological and other conditions might affect its establishment and multiplication, and which of these have operated consistently, and investigating the affecting factors to find whether any of them can be easily controlled by man. The co-ordination and interpretation of the results are discussed and illustrated by data on *Cochliomyia hominivorax*, Coq. (*americana*, Cush. & Patt.). A correlation chart was developed and proved useful, at least in preliminary correlations. One chart is given showing the populations of females of *C. hominivorax* and co-ordinated factors (rainfall, temperature, domestic animals per sq. mile, sheep and goats per sq. mile and percentage of land cultivated) for a period of $2\frac{1}{2}$ years at a certain place in Texas and a second giving the same data for several localities in the same State in one of the months covered by the first. To complete the study, all stages of the insect must be included.

PAPERS NOTICED BY TITLE ONLY.

BOUVIER (G.). **Contribution à l'étude des Tabanidés de la Suisse.**—*Mitt. schweiz. ent. Ges.* **18** pt. 1 pp. 15–47, 20 figs., many refs. Berne, 1940. **Note sur l'armature génitale des Tabanidés.**—*T.c.* pt. 2 pp. 57–61, 3 figs., 3 refs. **Quelques observations biologiques sur les Tabanidés.**—*T.c.* pt. 4–5 pp. 280–285, 13 figs., 2 refs.

JORDAN (K.). **A new Rat-flea** [*Ceratophyllus* (*Nosopsyllus*) *wualis*, sp. n.] **from China.**—*Entomologist* **74** no. 935 pp. 85–86, 3 figs. London, 1941.

BUSVINE (J. R.). **Control of the Bed Bug.**—*Lancet* **240** no. 6123 repr. 8 pp., 19 refs. London, 1941.

Methods of controlling the bed bug [*Cimex lectularius*, L.] are reviewed from the literature. In a brief reference to the use of coal-tar heavy solvent naphtha as a fumigant [*R.A.E.*, B **28** 72], it is stated on the authority of a paper by H. Taylor (*Chem. Ind. Rev.* **58** 1078. 1939) that repeated exposure to the fumes may cause lesions in the human liver. Results are also given of experiments carried out by H. S. Leeson with the two powders, AL. 16 and AL. 63 [*cf. R.A.E.*, B **29** 117], both of which are commercially available. All bugs, both nymphs and adults, confined in an open vessel on cloth powdered with these substances at the rate of 0·1 gm. per 40 sq. cm. were killed in 3–10 days at 32°C. [89·6°F.] and in 5–25 days at 17–24°C. [62·6–75·2°F.]. At 8–15°C. [46·4–59°F.], all nymphs died when they moulted, but some adults survived apparently unhurt for at least three weeks. The two powders, neither of which is harmful to man, seem to differ little in effectiveness, but experiments show that AL. 16 retains its power of killing bugs after at least a week's exposure to air.

BRUCE (W. G.). **Intravenous Injections of Arsenic ineffective in controlling Horn Flies on Cattle.**—*J. Kans. ent. Soc.* **13** no. 4 pp. 128–129. Manhattan, Kans., 1940.

An account is given of experiments in which intravenous injections of a commercial form of trivalent arsenic into a heifer, some of them in quantities as high as it could stand, failed to render its blood toxic to *Lyperosia* (*Haematobia*) *irritans*, L. Evidently a large proportion of the arsenical is excreted in the faeces and urine. The droppings were toxic to larvae of *L. irritans*, adult emergence from samples being irregular and sometimes as low as 7 per cent. One day after the last injection, the heifer was artificially wounded and infested with about 150 larvae of *Cochliomyia hominivorax*, Coq. (*americana*, Cush. & Patt.), all of which were developing normally at the end of the third day, when about 100 were removed. The remainder completed normal development and gave rise to adults that deposited viable eggs.

MEYER (J. R.). **Prova facil para verificação da atividade dos timbós.** [An easy Test for ascertaining the Toxicity of Timbo.]—*Biologico* **6** no. 11 pp. 319–321. São Paulo, 1940. **Tratamento de algumas ectoparasitoses pelo timbó.** [The Treatment of some Infestations of Ectoparasites by Means of Timbo.]—*T.c.* no. 12 pp. 352–355.

In the first paper, the author describes a simple method of evaluating the toxicity of roots of timbo [*Lonchocarpus*] in Brazil by the time taken by water extracts to kill a small local fish (*Phalloceros caudomaculatus*), and in the second he gives directions for preparing a dilute water extract of the roots for use with soap solution in dips against lice and fleas on domestic animals. The concentrations of both extract and soap required in the dips, which are shown in a table, depend on the toxicity to the fish of the particular sample of timbo used. The dips are also effective against mild forms of mange, but severe mange, such as that caused in dogs by *Demodex canis*, Leydig, which penetrates well into the skin, are best treated with an embrocation [*cf. R.A.E.*, B **27** 41]. To prepare this, two parts of root powder of high toxicity to the fish are mixed with 10 parts benzene or carbon tetrachloride

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and kept for two days in a tightly corked bottle. The mixture is then incorporated with 100–200 parts Diesel oil, cotton-seed oil or even kerosene.

KRANEVELD (F. C.) & DJAENOEDIN (R.). **Proeven over de overbrenging van miltvuur door den *Tabanus rubidus* Wied. op paard en buffel.** [Experiments on the Transmission of Anthrax by *T. rubidus* to Horses and Buffalos.]—*Veeartsenijk. Meded.* no. 83, 42 pp., 1 pl., 7 graphs, many refs. Buitenzorg, 1940. (With a Summary in English.)

The authors briefly review the literature on the transmission of anthrax by insects, from which it appears that investigations have so far been confined almost exclusively to small laboratory animals, and give a detailed account of experiments at Buitenzorg (Java) on its transmission to horses and buffalos by *Tabanus rubidus*, Wied., which is common in this district. The flies were fed on infected horses, buffalos or guineapigs, which served equally well as a source of infection, and all those used in the tests were subsequently shown to have ingested infected blood. The test animals came from districts where there had been no anthrax vaccination during the five preceding years and where no cases of anthrax had been observed. The first experiments were made by allowing flies to feed for periods of about 3–9 minutes on the infected source and then transferring them with the least possible delay to the test animals, on which they completed their meal. Of the 14 horses used, 11 subsequently died from anthrax, and two of these had been fed on by single flies, while in the case of buffalos fatal infections were caused only by batches of 75 flies or more, though evidence of infection was shown by two animals on which 50 flies had fed.

Since Tabanids are known to feed only at intervals of about 1–2 days in nature, further experiments were carried out in which the flies were transferred to healthy horses 48 hours after their infecting feed. Of the six horses used, one, on which 40 flies were fed, died of anthrax, and another, on which 10 were fed, showed evidence of slight infection. The four that were not infected included one on which 20 flies were fed. In a bacteriological examination of the mouth-parts of the flies used in this test, only 50 per cent. of the material was positive, so that the ability to transmit was probably reduced by the blood on the surface drying before the bacteria could sporulate, and also, when spores were formed, by their failure to become detached when the insect fed. It is considered that in the case of horses there is considerable possibility of transmission under natural conditions, although this is reduced by the fact that their defensive reaction to the flies ceases soon after they are infected, so that many flies would complete their meal and not seek another for 24–48 hours. Of three buffalos that contracted fatal infections, one showed no bacteria in the peripheral blood up to death ; in another the number of circulating micro-organisms appeared small, while in the third large numbers of bacteria were visible 10 hours before death. This last buffalo reacted so violently to the flies that a large number ceased feeding. Such animals are dangerous sources of infection, as the flies that are driven away at once seek another animal. It is concluded that the part played by Tabanids in spreading anthrax among large domestic animals may be considerable. The preference of blood-sucking insects

for certain types of host [*cf. R.A.E.*, B **19** 22] may explain why one type of animal remains free from anthrax while others in the same district are infected.

Some evidence was obtained that slight infections caused by insects may have an immunising effect.

GANSSER-BURCKHARDT (A.). **Beitrag zur Differentialdiagnose von *Hypoderma bovis* und *Hypoderma lineatum* schweizerischer Herkunft und deren geographische Verteilung.** [A Contribution to the Identification of *H. bovis* and *H. lineatum* of Swiss Origin and their geographical Distribution.]—*Mitt. schweiz. ent. Ges.* **18** pt. 1 pp. 1–14, 1 map, 11 refs. Berne, 1940.

The author discusses from material taken in Switzerland characters differentiating the larvae and adults of the ox warble-flies, *Hypoderma bovis*, DeG., and *H. lineatum*, Vill., and the oviposition habits of the two species. The eggs are very difficult to find on the hairs of the cattle, but in Switzerland they appear to be deposited on hairs on any part of the body of the animal. The method of oviposition is not a reliable character for distinguishing the species, since *H. lineatum*, which is supposed to lay its eggs in rows, sometimes deposits them singly, in the same way as *H. bovis*. *H. bovis* predominates in the country as a whole ; *H. lineatum* is the more numerous in the western half, but is almost absent from the eastern half.

JACKSON (C. H. N.). **The Analysis of a Tsetse-fly Population.**—*Ann. Eugen.* **10** pt. 4 pp. 332–369, 4 figs., 4 refs. London, 1941.

The copious data on populations of *Glossina morsitans*, Westw., given in this paper were obtained between July 1938 and December 1939 in Tanganyika Territory by a method developed in earlier ones [*R.A.E.*, B **22** 12 ; **25** 162 ; **28** 140] and further modified. Flies were caught, and marked or re-marked on the first three days of each week, on a square plot 16 sq. miles in area. The mathematical treatment of the data is explained. As comparatively few females were caught, most of the figures examined relate to males. The number of males leaving the square in excess of those re-entering it amounted to only 3 per cent. of the population, but the total leaving the square weekly was about a quarter of the population. Most of these emigrants had returned a week later. This is shown to be partly because of random re-immigration, but also because the individual flies live in confining " ambits " or zones of activity along the lines of contact of woodland and seasonal swamps and only a few drift out to other ambits. The average distance travelled in a week in any one direction was less than half a mile. Because of the effect of the ambits, this distance was scarcely exceeded in later weeks.

The method described in a previous paper [**28** 140] for obtaining death and emigration or emergence and immigration rates is only valid if the survival curves decline in geometrical progression, as until recently they were thought to do and as they do in fact when the flies die strictly at random and the marking area is large enough to prevent rising re-immigration with the passage of time. However, when some flies survive until they die of old age, which often occurs in the rainy season, the method must be modified. In the dry season, the expectation of life is approximately equal at all ages, probably

because of the danger of starvation [**25** 162]. The average length of life of males is about 4 weeks for the year, varying from 2 weeks in the very dry season to about 6 or more at the height of the rains. A further correction in the method of estimating population is necessitated by the effect of the ambits and is described. Females move more through the savannah than males, possibly penetrating further into the woodland for larviposition, and it is probable that they live considerably longer.

Between August 1938 and August 1939, similar observations were made in a square in country from which the normal annual grass fires were excluded. Here, the mean weekly dispersal rates were about the same as in the other square, and there was again little sign of a seasonal trend, but the flies had a larger outer ambit and there was some seasonal variation in its size. Flies became scarcer in the dry season and early rains (until January) because of a fall in the emergence rate, then the population rose until the early dry season (June), as emergence became normal and life abnormally long, whereas the population in the other square apparently rose from September to January and then remained steady till October. The numbers caught in the two areas give comparative indices of population at any one season, but because of variation in activity, do not give reliable comparisons of real density from one season to another.

BEQUAERT (J.). **A Note on *Hippobosca martinaglia* Bedford (Diptera, Hippoboscidae).**—*Psyche* **48** no. 1 pp. 22–23. Cambridge, Mass., 1941.

Specimens of a *Hippobosca* collected on the type host (*Aepyceros melampus*) and at the type locality in Swaziland of *H. martinaglia*, Bedford [*R.A.E.*, B **25** 152] cannot be separated from *H. fulva*, Aust., of which *H. martinaglia* is therefore regarded as a synonym.

BAXTER (G. R.). **The House-fly, Public Enemy No. 1.**—*Agric. J. Fiji* **11** no. 3 pp. 66–70. Suva, 1940. **The Control of the Fly Nuisance.** —*T. c.* no. 4 pp. 96–98.

The first paper comprises a popular account of the bionomics of *Musca domestica*, L., with very brief notes on blowflies and a short survey of measures against adult flies, such as the screening of rooms and food and the use of fly sprays, traps, poison baits and fly papers. The second paper, which deals with the prevention of breeding by the proper disposal of manure, is an adaptation of one by T. W. Hogan that appeared in *Health Bulletin* (Victoria, Australia) Jan.–June, 1940. In both, attention is drawn to the fact that cow dung is an important breeding medium for *Musca domestica* and allied species in Fiji [*R.A.E.*, B **29** 57].

SIMMONDS (H. W.). **A Predatorial Wasp of Cockroaches.**—*Agric. J. Fiji* **12** no. 1 p. 26. Suva, 1941.

Ampulex compressa, F., preys upon large cockroaches in India, Réunion and Mauritius. The scarcity of cockroaches in Mauritius as compared with their abundance in Samoa and Fiji suggests that the introduction of this Sphegid if practicable might be of value. In longevity tests in Mauritius on one pair kept in lamp glasses and fed

on honey-agar, the male lived a few days only but the female survived 80 days. There should be no great difficulty in transporting the species by air from Mauritius to Fiji, and as it is so long-lived and hunts its prey in buildings, a limited colony would probably suffice.

SEARLS (E. M.). **Droplet Size of Insecticides. If the Mist is too fine when sprayed, it may reduce the Effectiveness of a liquid Insecticide.** —*Soap* **17** no. 2 pp. 94–96, 1 fig., 1 ref. New York, N.Y., 1941.

The unsatisfactory results sometimes obtained with sprays are attributed to the prevalent, mistaken impression that in order to be effective a spray must be very finely divided. This applies particularly to household and cattle-fly sprays, as the usual carrier for these is oil, which, on account of its very low surface tension, is much more easily dispersed than water. If an atomiser with a fixed nozzle made to apply sprays with a kerosene base is used with a spray of the cattle-fly type containing a base oil with a Saybolt viscosity of 70 or more, so fine a mist is produced that the cow will be enveloped in a fog of spray but little if any will settle on it. A kerosene-base spray in the same sprayer will wet the cow quickly [*cf. R.A.E.*, B **25** 85]. One reason for the failure of the fine mist may lie in Stokes' Law of Resistance, according to which the loss of velocity of droplets of different sizes is inversely proportional to the square of the radius. This law applies equally to all sprays. When directed against some insects, very fine droplets are less effective than larger ones, which are not carried by the current of air as it is turned aside by the body of the insect, but have sufficient momentum to break through and hit the insect directly. The aimless drifting of fine droplets may account for the apparent failure of a contact insecticide in heavy oil to give as good a kill as it does in a light oil in a Peet-Grady chamber where the atomiser used generally has a fixed nozzle adjusted for the application of oils within the kerosene range. With no momentum and with little mass, the droplets could not be expected to hit the test flies as effectively as larger ones. An experiment is described in which a spray of 7 per cent. of a well known insecticide in a refined kerosene base applied from a nozzle adjusted to produce fine droplets on brown paper at 3 ft. soon settled on the floor of a stable and knocked down practically all the flies within 15 minutes, whereas a spray of the same insecticide in heavy oil (100 Saybolt) with the nozzle adjusted as for the previous one remained drifting in the air for several minutes and apparently failed to injure a great number of flies. When the nozzle was adjusted to produce similarly sized drops with the heavy oil, there was no observable difference at the end of 15 minutes in the effectiveness of the two sprays.

KRULL (W. H.). **Investigations on possible Intermediate Hosts, other than Oribatid Mites, for** *Moniezia expansa*.—*Proc. helminth. Soc. Wash.* **7** no. 2 pp. 68–71, 14 refs. Washington, D.C., 1940.

An account is given of investigations with numerous insects and other invertebrates collected in a contaminated sheep pasture in Maryland, which indicate that Oribatid mites are probably the only intermediate hosts of the sheep tapeworm, *Moniezia expansa* [*cf. R.A.E.*, B **28** 135, etc.]. Field observations suggest, however, that certain invertebrates, including ants, centipedes and earthworms,

may carry the eggs of *Moniezia* into the soil and deposit them in situations favourable for their survival, thus making them available to the mites for a longer period than would otherwise be possible.

DAVIS (G. E.). *Rickettsia diaporica*: **its Persistence in the Tissues of *Ornithodoros turicata*.**—*Publ. Hlth Rep.* **55** no. 41 pp. 1862–1864, 2 refs. Washington, D.C., 1940.

In the experiments described, 38 individuals of *Ornithodorus turicata*, Dugès, in the advanced nymphal stages engorged on a guineapig with a clinical infection of the original Montana strain of American Q fever [*R.A.E.*, B **27** 146; **28** 230]. Most of them were tested for transmission of *Rickettsia diaporica* by allowing them to engorge completely on guineapigs 7 weeks to 20 months later and to detach voluntarily, thereby insuring the wetting of the wound with coxal fluid, and for the presence of the organism in the tissues by subcutaneous injections of saline suspensions of ground ticks. In no case was there any evidence of the infection being transmitted to the guineapigs on which the ticks fed, but the rickettsia persisted in the tissues of 22 out of 29 ticks, infections being produced by injections made 0–1,001 days after the infective feed. No guineapigs showed signs of infection after the progeny of females that had ingested infective blood had been tested on them for *R. diaporica* by feeding and injection of larvae and nymphs. The excreta of infected ticks injected subcutaneously into guineapigs from less than 1 hour to 16 days after the ticks had fed produced typical infections in the guineapigs in 6 tests out of 8. There was no evidence of "reactivation" [**11** 89] of the rickettsia.

BRIGHAM (G. D.) & WATT (J.). **Highly Virulent Strains of Rocky Mountain Spotted Fever Virus isolated from Ticks (*D. variabilis*) in Georgia.**—*Publ. Hlth Rep.* **55** no. 46 pp. 2125–2126, 1 ref. Washington, D.C., 1940.

Two strains of virus, one recovered from an adult male of *Dermacentor variabilis*, Say, taken in Georgia on a dog, the owner of which was suffering from a typical attack of the disease, and the other from two engorged adult females and two adult males of the same tick taken on a neighbour's dog, were shown to be Rocky Mountain spotted fever virus by the clinical picture in guineapigs and by cross-immunity tests with typical western and eastern strains of Rocky Mountain spotted fever. The symptoms in guineapigs were those of the western strain, but the mortality was not so high.

TOPPING (N. H.), CULLYFORD (J. S.) & DAVIS (G. E.). **Colorado Tick Fever.**—*Publ. Hlth Rep.* **55** no. 48 pp. 2224–2237, 5 figs., 9 refs. Washington, D.C., 1940.

In addition to clinical data on Colorado tick fever [*cf. R.A.E.*, B **19** 256], information is given on its epidemiology from a study made during 1940 and from data provided by the Colorado State Board of Health and the city health officer of Boulder. Between January 1938 and the end of July 1940, there were 175 reported cases in Colorado. In 1938 and 1940, the peak occurred in June and in 1939 one month

earlier. This coincides with the seasonal distribution ot *Dermacentor andersoni*, Stiles, and of Rocky Mountain spotted fever. In Boulder, where the tick season is rather early and ends quickly, presumably because of the dry heat in June, the peak of incidence of Colorado tick fever in the period 1930–39 occurred in May. The fever has also been recorded from Utah, Idaho and Wyoming, and its distribution in Colorado coincides with that of *D. andersoni*. Like Rocky Mountain spotted fever in this area, it is largely a disease of adult males who are more likely than other persons to be exposed to tick bites through their occupation. In all the 11 cases reported to the field laboratory in Boulder between 6th May and 4th June 1940, and investigated in detail, there was a history of tick bite. Possible modes of transmission other than by ticks are discussed and eliminated. The histories of the cases failed to reveal any consistent contact with an Arthropod other than ticks or with other animals. All attempts at isolation of the causative agent from infected persons and from ticks alleged to have caused the syndrome in some of the cases were unsuccessful.

Fulton (J. D.), Greutter (J. E.), Muether (R. O.), Hanss (E. B.) & Broun (G. O.). **Observations concerning *Culex pipiens* as a possible Carrier of St. Louis Encephalitis.**—*Proc. Soc. exp. Biol.* **44** no. 1 pp. 255–256, 6 refs. New York, N.Y., 1940.

It has been shown by Casey & Broun that St. Louis encephalitis [*cf. R.A.E.*, B **24** 253] appears to have a higher incidence in those areas of the city and county that are adjacent to small streams and open ditches, which suggests the possibility that this form of the disease may be transmitted by a water-breeding insect. Webster, Clow & Bauer demonstrated that *Anopheles quadrimaculatus*, Say, can take up the virus and retain it through life, but it did not transmit it to mice or monkeys on which it fed. Attempts were made after the epidemic in 1933 [*loc. cit.*] to transmit the virus from man to man by means of various species of mosquitos, but without success. Since *Culex pipiens*, L., is the commonest mosquito in the St. Louis district, the authors investigated the ability of this species to become infected with the virus. Mosquitos that had fed on an infected mouse were killed in ether fumes, ground in a mortar, usually in batches of three, and diluted with 10 cc. salt-free broth, which was then passed through a Berkefeld filter. Serial dilutions of 1 : 5, 1 : 10 and 1 : 100 were made of the filtrates and 0·03 cc. of each was injected intracerebrally into three mice, which were kept under observation for 15 days. In 10 of 29 series of experiments some of the mice died, but in only 3 cases was the virus carried in serial transfers and proved by neutralisation tests to have been that of St. Louis encephalitis. The virus was not shown to survive for more than 10 days in the mosquitos, and its concentration in them was much smaller than that shown by Webster, Clow & Bauer to be present in *Anopheles quadrimaculatus*.

No evidence of infection was produced in mice by injection of filtered suspensions of macerated adults of *C. pipiens* from larvae placed in water containing a suspension of infected brain or of macerated eggs from mosquitos that had fed on infected mice. Healthy mice exposed for 12 hours to large numbers of mosquitos that had fed on an infected mouse and digested their blood-meal remained healthy after 15 days.

ROZEBOOM (L. E.). **The Overwintering of *Aëdes aegypti* L. in Stillwater, Oklahoma.**—*Proc. Okla. Acad. Sci.* **19** pp. 81–82. Norman, Okla., 1939. [Recd. 1941.]

It is shown from a brief review of the literature that the range of *Aëdes aegypti*, L., may be divided into a permanent region, where the temperatures are high enough for it to breed continuously, a border-line zone, where it hibernates in the egg stage, and a temporary summer region into which it may spread during warm weather but in which it does not survive the winter. The extent of this summer region is evidenced by the epidemics of yellow fever that occurred as far north as Philadelphia, New York and Boston before the method of controlling the disease was known.

A. aegypti seems to be fairly common in Oklahoma and becomes an annoying household pest in Stillwater during the latter part of the summer. As Stillwater is not far from its northern limit of permanent distribution, a laboratory colony was established from adults collected locally in 1937, and three batches of eggs from it were exposed to winter conditions to find if they would survive. They were kept throughout the winter on sand in wide-necked bottles ; two in one bottle were in a shed where they had some protection from snow and rain but none from cold ; the other bottle was placed on the ground outside. The eggs were brought into the laboratory and immersed in water in April. Only one larva hatched from the batch of eggs that had been kept outdoors and it died in the pupal stage, but large numbers hatched from the other two batches and developed into vigorous adults. During the winter there were several periods when the temperature dropped considerably below freezing point for 4–9 days in succession ; on the coldest day the maximum was 32°F. and the minimum 8°. The distribution of the mosquito at Stillwater in the summer of 1938 suggested that many eggs had survived the winter in nature. An unusually severe winter might possibly destroy all eggs exposed to it, but since the mosquito breeds in and around houses and barns, the protection thus afforded would probably be sufficient to ensure its permanent existence.

COVELL (G.). **Lectures on Malaria.**—*Hlth Bull.* no. 5 (*Malar. Bur.* no. 1) [iii]+33 pp. Delhi, Manager of Publications, 1940. Price 6*d.*

This bulletin consists of eight lectures on malaria and malaria-carrying mosquitos and is intended for the use of officials and others whose duties constantly bring them into contact with the disease. The subjects dealt with are the history and importance of malaria ; the parasites and how they are transmitted from man to man through the agency of Anopheline mosquitos ; some factors influencing the incidence of malaria, such as climate, which affects both the mosquito vector and the parasite, and physiographical features and agricultural methods, which affect the abundance of the mosquito ; the principles and economics of anti-malaria sanitation ; species control, the selection of sites for dwellings and bonification (land reclamation and the rendering of the land healthy for occupation) ; the relation between malaria and irrigation and rice cultivation ; the methods of investigating malaria, *viz.*, spleen and blood examinations, study of statistics, the dissection of mosquitos and study of the behaviour of the vector ; and finally methods of control.

COVELL (G.). **Anti-mosquito Measures with special Reference to India.**—*Hlth Bull.* no. 11 (*Malar. Bur.* no. 3) 5th edn (revd) iii+58 pp., 4 refs. Delhi, Manager of Publications, 1940. Price 9*d*.

The first and fourth editions of this summary of the chief methods employed in mosquito-control work in India appeared in 1927 and 1935 [*R.A.E.*, B **15** 144; **25** 216]. As the advances made during the last five years have necessitated the issue of a new edition, certain portions have been completely re-written, whilst the sections dealing with naturalistic methods of control have been grouped together.

EJERCITO (A.). **"Pampana Siphon" for automatic Flushing of a Stream as a naturalistic Method of Malaria Control. (Design I.)** —*Riv. Malariol.* **19** (1) no. 6 pp. 345–369, 1 map, 6 diagr., 6 figs., 9 refs. Rome, 1940. (With a Summary in Italian.)

The literature on the flushing of streams for the control of mosquito larvae is briefly reviewed, and an account is given of the use of automatic siphons for flushing a stream in the Philippines in which the rate of flow varied greatly with the rainfall. Three dams were built across the stream near its entry into a river and were separated by distances of about 180 and 55 yards. They consisted of clay filling between galvanised iron walls on a concrete foundation. A tube passing through each dam near the top was attached at the ends by elbow joints having an angle of 120° to tubes that sloped downwards and so formed the inlet and outlet of a siphon. All tubes were of cast iron with an inner diameter of 10 cm. The lengths of the horizontal and outlet tubes were 156–157 and 157 cm., but the inlet tube was 155 cm. long in one case and 130 cm. long in the others. Each outlet tube opened into a small concrete basin, so that a water-seal was formed.

When the water above the dam has risen high enough, the pressure causes the air confined above the water seal to bubble through it. After a time the decreasing quantity of air can no longer support the weight of water, and siphonic action then continues until the water level falls below the opening of the inlet tube. The series of flushings varied from three times a day to once in five days, according to the incoming water.

Data on the population density of Anopheline larvae in the stream before and after flushing were obtained by dipping. Two trials of this installation were made possible by the destruction of the dams by floods and subsequent re-building, and the results are recorded in detail in a series of tables for various seasons and various parts of the stream. They varied somewhat with the season, but the average percentage reduction in larval density was about 97 for *Anopheles minimus* var. *flavirostris*, Ludl., the well-known vector of malaria in the Philippines, and about 82 for other species, which included *A. filipinae*, Mnlg., *A. maculatus*, Theo., *A. barbirostris*, Wulp, *A. vagus* var. *limosus*, King, *A. annularis*, Wulp, *A. kochi*, Dön., and *A. subpictus* var. *indefinitus*, Ludl.

It is pointed out that the system described could be adapted to larger streams by having more than one siphon in each dam, but that dams of concrete and iron, which would resist floods, would ultimately be more economic, despite their higher initial cost.

ARCHETTI (I.). **Presenza di *Plasmodium malariae* nella regione fra Sagan e Omo (A.O.I.).** [The Occurrence of *P. malariae* between the Sagan and Omo Rivers.]—*Riv. Malariol.* **19** (1) no. 6 pp. 370–373, 1 map, 16 refs. Rome, 1940. (With a Summary in German.)

The author reviews the literature on the distribution in Eritrea and Italian Somaliland of malaria due to *Plasmodium malariae*, which has not been recorded there at altitudes of more than about 3,600 ft. He has himself found *P. malariae* in three villages in south-western Abyssinia, one at 1,700 ft. in the Sagan valley and the others at about 1,750 ft. on Lake Rudolph. No native cases due to *P. vivax* were observed in the latter district, and malaria due to *P. malariae* was at least as widely distributed as that due to *P. falciparum* (*immaculatum*). Larvae of *Anopheles gambiae*, Giles, and adults of *A. pharoensis*, Theo., were taken in the Sagan valley, and a single adult of *A. gambiae* and a few of *A. pharoensis* in one village on Lake Rudolph.

Since *A. gambiae* occurs at altitudes much higher than 3,600 ft. [*R.A.E.*, B **28** 62], it is concluded that it is, in general, resistant to infection by *P. malariae*, although it may be responsible for a limited amount of transmission under the special conditions of the low plateau region. *A. pharoensis* may also serve as a vector in this region.

CLARK (H. C.), KOMP (W. H. W.) & JOBBINS (D. M.). **A Tenth Year's Observations on Malaria in Panama, with Reference to the Occurrence of Variations in the Parasite Index, during continued Treatment with Atabrine and Plasmochine.**—*Amer. J. trop. Med.* **21** no. 2 pp. 191–216, 10 refs. Baltimore, Md., 1941.

This tenth and final annual report on observations in certain villages in Panama in which the possibility of malaria control by means of drugs without anti-mosquito measures was being investigated [*cf. R.A.E.*, B **28** 120] deals with the period from September 1939 to August 1940. Information was again obtained on the seasonal prevalence of Anophelines. The year was exceedingly dry. There was as usual no correlation between rainfall and malaria parasite rates, nor was there any between rainfall and the peak of emergence of *Anopheles albimanus*, Wied. At the time of maximum emergence, the country was very dry and the palm-thatched houses were among the best available resting places for the mosquitos. As the rains began, satisfactory resting places in the jungle increased rapidly, and catches in houses became smaller. The Gatun and Madden dams were in use from August 1939 to April 1940, and that caused low water levels and slow current in the Chagres river, with a consequent increase in Anopheline breeding, but the lowering of the gates of the Madden dam in April raised the level of the water about 8 ins. and submerged the anchored plants, thus exposing the larvae to attack by fish. The application of copper sulphate sprays to large areas along the banks of other water courses in February and March retarded the growth of water plants and destroyed algae, with a resultant reduction in anopheles population. The monthly parasite rates were high from August 1939 to June 1940, these high rates being associated with a large population of Anophelines. Although the intense sunlight and clear waters of the dry period favour the growth of aquatic plants and mosquito larvae, the females that emerge and feed on gametocyte

carriers at such times have much more difficulty in surviving the incubation period of the plasmodia within their bodies than those that emerge under other conditions, and this undoubtedly offsets their numerical superiority and tends to maintain the number of potentially infective individuals at a fairly constant level throughout the year.

The results of the ten years' experience in attempting to control malaria by making monthly surveys and treating positives with drugs indicate that it is impossible to eradicate malaria parasites in this way or to reduce them to the point where transmission is very greatly reduced. Drugs cannot prevent an epidemic when unusually great numbers of anopheles are present.

BUGHER (J. C.). **The Use of Baby Mice in Yellow Fever Studies.**—*Amer. J. trop. Med.* **21** no. 2 pp. 299–307, 5 refs. Baltimore, Md., 1941.

In an attempt to discover a test animal obtainable in large numbers and at low cost for studies on the transmission of yellow fever, it was found that suckling Swiss mice less than 9 days old are highly susceptible to both the neurotropic and the viscerotropic strains of yellow-fever virus administered subcutaneously. Their susceptibility is equivalent to that of adult mice inoculated intracerebrally, but the incubation period in them is longer, and the marked difference in incubation times of the strains does not occur. Tests to determine the extent to which various types of haematophagous Arthropods would bite suckling mice were made with all the more common Colombian mosquitos that bite man, including species of *Psorophora*, *Haemagogus*, *Mansonia* and *Anopheles*, and also with young nymphs of *Rhodnius prolixus*, Stål, and larvae of various ticks, and in general, no great difficulty was met with. When mosquitos refused to bite the mice, they also refused to attack other hosts. The technique for using suckling mice in insect transmission experiments is described, and an account is given of an illustrative experiment with infected *Aëdes aegypti*, L. Individuals that bit without engorging transmitted jungle virus to the mice about as frequently as those that became filled with blood.

TRAVIS (B. V.), KNIPLING (E. F.) & BRODY (A. L.). **Lateral Migration and Depth of Pupation of the Larvae of the Primary Screwworm *Cochliomyia americana* C. and P.**—*J. econ. Ent.* **33** no. 6 pp. 847–850, 2 refs. Menasha, Wis., 1940.

The distance that larvae of *Cochliomyia hominivorax*, Coq. (*americana*, Cush. & Patt.) migrate after they have dropped to the ground and the depth at which they pupate were studied in Georgia under field conditions during the autumn of 1935 and the spring of 1936 in order to determine the advisability of further studies on methods of controlling larvae and pupae of this species in carcasses of animals or in the soil near infested animals [*cf. R.A.E.*, B **29** 82]. As an infested animal usually hides in a secluded spot before it dies, the larvae have often dropped to the ground before it is found. Tests have indicated that they begin to leave the carcass immediately after the death of the animal and that practically all have left it within 48 hours.

To determine the extent of lateral migration, an infested goat was so caged that the larvae that emerged from the wound dropped to the ground in an area one foot in diameter, and when all had pupated, metal hoops, 8 ins. high and 1, 3, 5 and 7 ft. in diameter, were placed in concentric circles with the inner circle round the area where the larvae had dropped, and gauze was soldered to the tops of the hoops. The flies emerging into each of the cages so made were counted. In a second test, a dead goat infested near the hip with mature larvae was removed from the ground when the larvae had dropped and the hoops placed in position as before. After all larvae had pupated, the soil from each circle was sifted and the pupae counted. Over 89 per cent. of the larvae pupated within 18 ins. of the centre of the area on which they had dropped. When a goat infested with mature larvae in the region of the hip was killed and the carcass was left in place until the larvae had pupated, 69 per cent. of the larvae pupated under the carcass, and practically all the others within a contour 1 ft. from it. No pupae were found more than $1\frac{1}{2}$ ins. below the surface. In soil exposed to the weather, whatever its type, practically all the larvae pupated within $\frac{1}{2}$ in. of the surface. In dry sand under a house, practically all pupated at $\frac{1}{2}$ to $1\frac{1}{4}$ ins. below the surface. Larvae tended to pupate in clumps of vegetation.

It is concluded that since most of the larvae leave a carcass so promptly and pupate near it and near the surface of the soil, the treatment of the soil may prove more important than the destruction of the carcass itself. Treatment should extend at least $2\frac{1}{2}$ ft. in all directions from the place where the larvae dropped and should be effective at a depth of about 1 in.

MELVIN (R.) & BUSHLAND (R. C.). **The Nutritional Requirements of Screwworm Larvae.**—*J. econ. Ent.* **33** no. 6 pp. 850–852, 2 refs. Menasha, Wis., 1940.

To obviate the necessity of using living animals for rearing larvae of *Cochliomyia hominivorax*, Coq. (*americana*, Cush. & Patt.), which in nature are obligatory parasites of warm-blooded animals, a method of rearing them on artificial media was developed [*cf. R.A.E.*, B **29** 83] after a study of their nutritional and temperature requirements. The results of further studies, together with notes on incidental observations, are given in this paper. The medium that has been used with success for a year consists of 1 litre water, 6 cc. formalin (39 per cent. formaldehyde), 1 kg. finely ground lean beef and 500 cc. citrated beef blood (3 gm. sodium citrate per litre blood). The ingredients are thoroughly mixed, in the order given, in a galvanised tub, about 15 ins. high and 2 ft. in diameter and the tub is kept in a warm room (85–100°F.). Newly hatched larvae are placed on the medium and begin feeding immediately. After 3 days, they are transferred to a tub of fresh medium, where they feed for a further 3 or 4 days before growth is complete. During the first 3 days, several thousand larvae may be kept in one tub, but during the second period, about 2,000 will exhaust the food supply. When some of the larvae have ceased feeding, the tub is tilted over another containing about one inch of moist sand, which the larvae enter to pupate. Migration of the whole culture usually takes about 2 days. Rearing in this manner through 88 consecutive generations effected no apparent change in the biology,

physiology or morphology of the insect. Variations may be made in the formula, but the amount of formalin should not be altered. Whatever the size of the container chosen, enough medium should be used to fill it to a depth of about an inch.

Considerable study was given to the rearing of larvae on sterile media. No method was devised for rearing large numbers of larvae aseptically, but several media suitable for limited numbers were developed. One of the most satisfactory consisted of 50 cc. of a mixture containing 25 per cent. egg yolks, 25 per cent. whole sweet milk, 1 per cent. agar-agar and 49 per cent. water. This was placed in a 250 cc. Erlenmeyer flask, plugged with cotton-wool and autoclaved. When the mixture had cooled, eggs that had been sterilised in a solution of alcoholic mercuric chloride were introduced aseptically. The larvae matured rather rapidly and in many cases escaped or pupated in the plug. Though tests for aerobic and anaerobic bacteria were negative during the development of the larvae, they were often positive after several larvae had escaped, and no sterile pupae were obtained. It was found possible to obtain a few sterile pupae and flies by placing the medium in a 50 cc. beaker, standing the beaker in a jar containing 1 in. of washed sea sand, soldering a short piece of copper tubing 1 in. in diameter into the lid of the jar and plugging it with cotton-wool. The whole was autoclaved, and when it had cooled, sterilised eggs were introduced through the tube. Pupation took place in the sand.

In tests on the effect of adding toxic materials to the nutritional medium, dextrose and sucrose, copper sulphate, boric acid, arsenic trioxide and thiodiphenylamine (phenothiazine) at 2·6, 0·03, 0·17, 0·003 and 0·03 per cent., respectively, permitted development and in some cases were quite harmless, but at 6·7, 0·07, 0·33, 0·03 and 0·05 per cent., respectively, were lethal. The fact that the larvae develop in the media in spite of the presence of relatively large amounts of insecticides shows that the media have an abundance of the nutritive materials necessary for growth. Larvae completed their development in fresh wounds in the crow, English sparrow and garden toad, but attempts to rear them on horned frogs were unsuccessful.

Hoskins (W. M.), Bloxham (H. P.) & Van Ess (M. W.). **The insecticidal Effects of organic Compounds. 1. Toxicity of Sulfur and Nitrogen Compounds to Fleshfly Larvae.**—*J. econ. Ent.* **33** no. 6 pp. 875–881, 15 refs. Menasha, Wis., 1940.

This paper, the main contents of which have been noticed elsewhere [*R.A.E.*, A **29** 407], comprises a brief discussion of the advantages and disadvantages of using *Lucilia sericata*, Mg., as a standard insect for toxicity tests with organic compounds, with an account of the technique and the results of experiments on the larvae with a number of compounds containing amino nitrogen, sulphur or both in a synthetic diet. The outstanding feature of the investigation was the high toxicity of thiourea ; on the basis of the concentration required for 95–100 per cent. mortality, this compound and several of its derivatives are as toxic as rotenone and distinctly more toxic than nicotine. Preliminary tests indicated that it is also highly toxic to larvae of *Musca domestica*, L., and might afford a practical means of control. It has little toxicity to adults of *Lucilia*.

Underhill (G. W.). **Some Factors influencing Feeding Activity of Simuliids in the Field.**—*J. econ. Ent.* **33** no. 6 pp. 915–917, 5 figs. Menasha, Wis., 1940.

As observations on the feeding of Simuliids on turkeys in Virginia [*cf. R.A.E.*, B **28** 173] revealed considerable fluctuation in the activity of the flies, the possible relation between activity and meteorological factors was examined in 1936–39. A turkey was taken on many occasions and under different weather conditions to localities where flies were known to be present, and the relative number of flies was observed and the number feeding on the turkey recorded. There was a definite relation between feeding and temperature, 83 per cent. of the flies that fed doing so at 75–85°F., and very few below 70 or above 90°F., though they were flying in swarms at 65–95°F. Relative humidity did not appear to have any important effect, as flies fed when it was as low as 42 and as high as 89 per cent., but 80 per cent. of the feeding occurred between 55 and 75 per cent., with the peak between 65 and 75. Few flies fed at less than 50 or more than 80 per cent., but the observations at these humidities were made under unfavourable temperature conditions. Flies appeared and fed most readily when the air was calm or there was only a slight breeze. They rarely appeared when there was a strong wind. They seemed to feed less during an east or north-east wind than during a south or west wind of the same velocity, but this reduction in feeding was probably due to the attendant low temperature and high atmospheric pressure. The flies fed most actively at a low atmospheric pressure or following a rapid fall in the barometer. Maximum feeding took place at barometric pressures of between 27·85 and 28·05 ins. (at an elevation of 2,000 ft.).

Fisk (F. W.) & Le Van (J. H.). **Mosquito Collections at Brownsville, Texas.**—*J. econ. Ent.* **33** no. 6 pp. 944–945, 3 refs. Menasha, Wis., 1940.

Records by half months are given of the mosquitos taken in light-traps at Brownsville, Texas, between 29th November 1939 and 1st May 1940. The rainfall and mean maximum and minimum temperatures for the same periods are also shown. In addition to the 25 species taken in the traps, one was reared from larvae taken in a tree-hole. Notes are included to show which species are multi-brooded and which breed throughout the winter. Only one example of *Aëdes aegypti*, L., was taken, but the other mosquitos included two, *Deinocerites spanius*, D. & K., and *Culex chidesteri*, Dyar, which are new records for the United States.

Sabrosky (C. W.). **Chloropids swarming in Houses.**—*J. econ. Ent.* **33** no. 6 pp. 946–947, 1 ref. Menasha, Wis., 1940.

Very large numbers of Chloropids, identified as *Chloropisca annulata*, Wlk., were observed in Michigan in June 1940 in a hotel in which smaller numbers had occurred in previous years. This is the first known record of mass invasion of a building by Chloropids in America, though they have frequently been recorded in Europe [*cf. R.A.E.*, B **22** 60; **23** 270; **26** 128]. The flies cause considerable annoyance, but do no damage and can be easily destroyed with sprays or dusts of pyrethrum.

MAIL (G. A.). **Infestation of a High School by *Oeciacus vicarius* Horv.**—*J. econ. Ent.* **33** no. 6 p. 949. Menasha, Wis., 1940.

Fumigation of the building with formaldehyde having failed to control insects reported to be biting many of the students at the high school at Banff, Alberta, early in June 1940, specimens were examined and identified as *Oeciacus vicarius*, Horv. [*R.A.E.*, B **18** 122 ; **23** 209]. It was then learnt that some swallows' nests, of which there had been many under the eaves of the building for some years, had been dislodged by the use of a hose and water under pressure two weeks before the bites were reported. Obviously the bugs, on being disturbed, had made their way into the building. Destruction of the remaining nests and fumigation of the building with hydrocyanic acid gas apparently controlled the infestation, but the swallows were rebuilding their nests early in July.

RUNNER (A. G.). **Occurrence of the Oriental Rat Flea in Columbus, Ohio.**—*Science* **93** no. 2405 pp. 111–112, 2 refs. New York, N. Y., 1941.

In addition to sea ports, *Xenopsylla cheopis*, Roths., is now known to occur at several places in the interior of the United States, but the only one in which it has been recorded as permanently established is Ames, Iowa [*cf. R.A.E.*, B **27** 132]. In the winter and spring of 1940 several hundred examples of this flea were taken in a box of animal food brought from the farm of the Ohio State University. In the autumn of the same year, 51 further examples were found on 18 out of 25 rats from the residential part of Columbus near the University campus. No other species of flea was seen. It is concluded that *X. cheopis* is probably established in Columbus.

KADNER (C. G.). **Pigeon Malaria in California.**—*Science* **93** no. 2412 p. 281, 1 ref. New York, N.Y., 1941.

Pigeons on a farm in southern California that were infested with *Pseudolynchia canariensis*, Macq., and showed symptoms of disease, varying greatly in intensity, but sometimes severe, were found to be infected with *Haemoproteus columbae*, of which this Hippoboscid is a vector. *H. columbae* had not previously been recorded from California, though it occurs in many parts of the United States. *P. canariensis* is widely distributed in the southern States and California.

BROWN (J. C.) & CROSS (J. C.). **A probable Agent for the Transmission of Fowl Paralysis.**—*Science* **93** no. 2422 p. 528. New York, N.Y., 1941.

The disease known as fowl paralysis or range paralysis is widespread in the United States and often causes heavy mortality. It appeared on a poultry farm in Texas in 1937 and caused the death of 61 fowls in a flock of 225 in that year, 92 in one of 345 in 1938 and 403 in 3 flocks with a total of 439 in 1939. As almost all the fowls in 1939 were infested with *Argas persicus*, Oken, experiments with this tick were carried out over a period of about a year. In the course of them, 12 healthy birds kept with paralysed birds in pens infested by the tick

all developed paralysis, and 111 out of 120 healthy birds similarly kept without paralysed ones did so, as compared with only one out of 129 kept in tick-free pens. Paralysis was also produced in birds that received an injection of a suspension of young ticks taken from a paralysed fowl. As a result of intensive control of the tick, only five fowls developed paralysis in the main breeding yards of the farm after September 1939.

FAIRCHILD (G. B.). **Notes on the Simuliidae of Panama (Dipt. Nematocera).**—*Ann. ent. Soc. Amer.* **33** no. 4 pp. 701–719, 39 figs., 7 refs. Columbus, Ohio, 1940.

As a result of collections recently made in Panama, almost exclusively in the Canal Zone or along the Pacific side west of it, the author records ten species of *Simulium*, three of which are new. Only two species had hitherto been known from Panama. Descriptions of the adults and notes on the distinguishing characters of the pupae and cocoons are given for each, and in most cases brief indications of the breeding places. Keys to the females and pupae are included. *Simulium haematopotum*, Mall., is stated to be the only one that attacks man at all readily at lower elevations on the Isthmus, but the others included *S. ochraceum*, Wlk., and *S. metallicum*, Bellardi, which are probable vectors of *Onchocerca caecutiens* in Guatemala [*R.A.E.*, B **23** 172].

PAPERS NOTICED BY TITLE ONLY.

CHRISTOPHERS (Sir S. R.), SINTON (J. A.) & COVELL (G.). **How to do a Malaria Survey.**—*Hlth Bull.* no. 14 (*Malar. Bur.* no. 6) 4th edn revd by G. Covell, vi+208 pp., 13 pls., 3 figs., refs. Delhi, Manager of Publications, 1939. Price 2*s.* 6*d.* [Recd. 1941.] [*Cf. R.A.E.*, B **19** 167.]

BARRAUD (P. J.). **A Practical Entomological Course for Students of Malariology.**—*Hlth Bull.* no. 18 (*Malar. Bur.* no. 9) 2nd edn revd by I. M. Puri vi+143 pp., 18 pls., 97 refs. Delhi, Manager of Publications, 1939. Price 2*s.* 6*d.* [Recd. 1941.] [*Cf. R.A.E.*, B **23** 97.]

PURI (I. M.). **Instructions for collecting and forwarding Mosquitoes.**—*Hlth Bull.* no. 13 (*Malar. Bur.* no. 5) 3rd edn (revd), 57 pp., 2 pls., 17 refs. Delhi, Manager of Publications, 1940. Price 9*d.*

OGASAWARA (H.). **A New Mosquito** [*Culex shakujiiensis*, sp. n.] **from Shakujii (Tokyo).** [*In Japanese with Description in English.*]—*Ent. World* **7** no. 63 pp. 237–239, 1 fig., 7 refs. Tokyo, 1939. [Recd. 1941.]

OGASAWARA (H.). **On the Genus *Megarhinus* in Japan, with Description of a new Variety** [*M. aurifluus formosensis* from Formosa]. [*In Japanese with some Descriptions in English.*]—*Ent. World* **7** no. 63 pp. 240–244, 9 refs. Tokyo, 1939. [Recd. 1941.]

WOOD (F. D.) & WOOD (S. F.). **Present Knowledge of the Distribution of *Trypanosoma cruzi* in Reservoir Animals and Vectors** [Triatomids].—*Amer. J. trop. Med.* **21** no. 2 pp. 335–345, 69 refs. Baltimore, Md., 1941.

STRONG (L. A.). **Report of the Chief of the Bureau of Entomology and Plant Quarantine, 19** [39–] **40.**—128 pp. Washington, D.C., U.S. Dep. Agric., 1940.

Part of this report (pp. 91–96) on entomological work in the United States in 1939–40 deals with Arthropods affecting man and animals. Reinfestation of chemically treated wounds with eggs of the screwworm fly [*Cochliomyia hominivorax*, Coq.] was never found to occur so long as the wound had a pH of 6·0 or below, but oviposition increased as the acidity of the wound decreased, being greatest when the pH was 7·0. Diphenylamine was extensively and successfully used by stock owners to protect wounds from infestation by *C. hominivorax* [*cf. R.A.E.*, B **28** 237]. Infestations of cattle by horn flies [*Lyperosia irritans*, L.] were reduced from 3,000–4,000 to 200 flies per head by the use of automatically operated traps [*cf.* **26** 248; **28** 238]. Tests involving about 7,000 head of cattle showed that a dip of sulphur and cubé gave satisfactory control of the short-nosed ox louse [*Haematopinus eurysternus*, Nitz.]. Cattle to which sulphur had been administered internally at the rate of 5 gm. elemental sulphur per 100 lb. live weight daily were still infested with lice after six months. A single dipping in the sulphur and cubé dip used for louse control killed a very small proportion of cattle grubs [*Hypoderma*], but two dippings at intervals of 17–19 days killed 67·3 per cent. of them.

Investigations of salt-marsh mosquitos along the east coast of Florida indicated that marshes where the grass *Distichlis* predominated had a population of about 46 million larvae per acre, and those where *Juncus* occurred about 30 million. The greater the proportion of these plants in the marsh flora, the greater was the mosquito population. Studies on the biology of mosquitos in the north-western States showed that eggs of *Aëdes vexans*, Mg., and *A. lateralis*, Mg., would remain viable in the soil for at least 6 years. In tests of pyrethrum-oil emulsion as a mosquito larvicide, larvae in the first and second instars were killed more quickly and with less emulsion than those in the third and fourth, and larvae of *Culex* and *Theobaldia* showed more resistance than those of *Aëdes*.

In extensive tests, spraying vegetation with nicotine sulphate for the control of the American dog tick [*Dermacentor variabilis*, Say] was fairly successful in some cases, since a reduction of 90 per cent. was apparent after 48 hours. By marking ticks found in nature and observing their movements from month to month, it was shown that they concentrate along roadways and paths frequented by men and dogs. This fact emphasises the need for an effective method of destroying the adults where they are thus concentrated. Studies on host relationships confirmed previous data to the effect that meadow mice [*Microtus*] are the most important hosts of the immature stages [**26** 251]. Rabbits were shown to be minor hosts. An experiment to determine the effect of meadow-mouse control, begun 2 years ago, indicated that tick infestation on the controlled area was reduced even though some mice came into the area.

LIU (Wei-t'ung) & ZIA (S. H.). **Typhus Rickettsia isolated from Mice and Mouse-fleas during an Epidemic in Peiping.**—*Proc. Soc. exp. Biol.* **45** no. 3 pp. 823–826, 16 refs. New York, N.Y., 1940.

It is generally considered that rats are the reservoir of "endemic" or murine typhus, and that it is transmitted from them to man by

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Xenopsylla cheopis, Roths. Occasional instances of success and failure to isolate strains of typhus from mice in various countries are cited, together with other evidence [*R.A.E.*, B **14** 108] that they may be reservoirs, but this has not been proved. In 1938, one of the authors examined over 100 mice from houses in Peiping without obtaining rickettsiae from any of them.

In March 1940, 9 out of 10 members of a household in Peiping became successively infected with typhus. They admitted that they harboured lice [*Pediculus humanus*, L.] during the greater part of the year and that fleas sometimes occurred in their clothes and bedding. Rats were scarce, but the house was infested with *Mus wagneri*, and 12 examples of *Leptopsylla segnis*, Schönh. (*musculi*, Dug.) were collected from 4 of these mice. By inoculating separately the brains of the mice and 10 of the fleas into two guineapigs, two typhus strains were obtained. Each strain was transmitted by a number of serial passages through guineapigs and white rats and produced typical symptoms in them, while a third strain, obtained from lice in the garments of one of the infected persons, showed no evident difference from the other two. The authors conclude that the typhus in this household was initially transmitted from mice to man by *L. segnis* and then from man to man by lice. It could not have been louse-borne epidemic typhus acquired originally from a human carrier since the infection of the mice from man would apparently be impossible. In general, however, rats must be of more importance than mice as reservoirs of endemic typhus, since they are more heavily infested with fleas and man is more readily attacked by *X. cheopis* than by *L. segnis*.

RAGHVENDER RAO (S.). **Rat-fleas of Calcutta : investigated from a Point of View of Epidemiology of Plague.**—*Indian J. med. Res.* **29** no. 1 pp. 51–70, 1 graph, 14 refs. Calcutta, 1941.

In view of the low incidence of plague in Calcutta as compared with that in certain other Indian cities, the suggestion that this might be due to a preponderance of *Xenopsylla astia*, Roths., over *X. cheopis*, Roths., in the rat-flea population and the limited scale of a previous study [*R.A.E.*, B **18** 170], a more extensive rat-flea survey of the city was undertaken as a preliminary to a proposed investigation of the factors responsible for the "long-term periodicity" of plague there. The survey was made in 10 selected wards and covered a period of nearly 12 months (15th January to 3rd September in 1936 and 15th October to 3rd December in 1938). From the 823 rodents and 62 shrews (*Crocidura coerulea*) examined, 2,963 *X. astia*, 1,923 *X. cheopis* and 2 other fleas were caught, giving a flea index of 5·5. There was a great variation in the index at different seasons of the year. The specific *astia* and *cheopis* indices and the numbers of each host examined were 5·8, 3·2 and 274 for *Mus* (*Rattus*) *norvegicus*, 3·7, 1·2 and 233 for *Gunomys varius*, 1·5, 2·8 and 220 for *M.* (*R.*) *rattus*, 3·3, 0·7 and 7 for *Bandicota indica*, 1·7, 1·7 and 62 for *Crocidura coerulea* and 0·5, 0·5 and 89 for mice (*Mus musculus*). The proportion of *X. astia* to *X. cheopis* varied from ward to ward as well as from one species of host to another. It is suggested that the distinctly higher general and the specific flea indices found during the present observations as compared with previous findings [*cf. loc. cit.*] are in all probability due to better technique and control over the collection of

rats and fleas rather than to any actual differences in the prevalence of fleas in the city. Compared with other Indian cities, Calcutta possesses high general and specific flea indices, and the flea factor is quite favourable for the spread of plague in an epidemic form, provided that the other factors concerned in the epidemiology of plague are also favourable.

JACOBI (E. F.). **Ueber Lebensweise, Auffinden des Wirtes und Regulierung der Individuenzahl von** *Mormoniella vitripennis* **Walker.** [On the Biology of *M. vitripennis*, the Way in which it finds its Host, and the Regulation of the Number of Individuals.]—*Arch. néerl. Zool.* **3** pt. 2–3 pp. 197–282, 41 figs., 2 pp. refs. Leiden, 1939. [Recd. 1941.]

A detailed account is given of investigations in which the Pteromalid, of *Mormoniella vitripennis*, Wlk., which is an ectoparasite of the pupae various Muscoid flies, was bred on puparia of *Calliphora erythrocephala*, Mg.

The following is based on the author's conclusions. The eggs are laid in the space between the host pupa and the puparium. The host is located at a distance by means of the smell emanating from the substances produced when the fly larvae are feeding on flesh [*cf. R.A.E.*, A **26** 150], while host finding at close quarters (up to 1·5 cm.) is due to the smell proceeding from the puparium itself. In neither case are optical stimuli involved. The ovipositor is inserted indifferently into normal puparia, empty puparia and those containing dead pupae but eggs are deposited only in puparia that contain living pupae. Furthermore, eggs are laid only if the ovipositor reaches an empty space within the puparium. If it pierces through to tissue no eggs are laid, but the female sucks at the puncture. Cannibalism does not occur among the larvae, but if many (30 or more) occur in a single host, competition for food leads to the production of small adults. Females less than 1·8 mm. in length cannot reproduce, and the proportion of such females rises with an increase in the number of parasites in a puparium.

VENKAT RAO (V.). **The Effect of stocking Rice Fields with Sullage at Khurda Road on Anopheline Breeding.**—*Indian med. Gaz.* **76** no. 2 pp. 86–88, 9 refs. Calcutta, 1941.

As there was a difference of opinion as to what effect rotting stubble in water in rice-fields after reaping would have on Anopheline breeding in the fields in the following rice season, malaria inspectors were asked to test this procedure in one field, in comparison with a field not so treated. It was intended to make a study of this kind on the Khurda Road in Orissa, where rice-fields constitute almost the sole breeding place of the local vectors of malaria, but as little or no stubble was left in the fields after harvest, it was decided to substitute crude sullage, as another form of rotting. The sullage used flowed through a drain which passes through a large number of rice-fields and leads to one of the branches of the Mahanadi river. The drain is regularly cleaned and oiled during December-March, for the control of *Culex fatigans*, Wied. [*cf. R.A.E.*, B **19** 48], which is the vector of filariasis [*Filaria bancrofti*]. However, the sullage is habitually diverted into the fields during the dry season (March–June) to facilitate

ploughing, and as the quantity used is excessive, sullage swamps are created in which *C. fatigans* breeds in large numbers. Oiling such swamps is both costly and inefficient. In the author's experiment, the sullage was let into the experimental field once a week during the dry season, but the flow was cut off as soon as a depth of half an inch was obtained, and the field usually dried in 24–36 hours, so that there was no danger of its becoming a sullage swamp. From the beginning of the rains, when the rice was sown, the fields were not dried until harvest, and the depth of water varied from one to three inches. Comparable larval samples were taken in the experimental and control fields from 1st July to 31st December 1939. The larvae of *Anopheles* in the samples from the control field comprised 21 of *A. barbirostris*, Wulp, 117 of *A. hyrcanus*, Pall., 175 of *A. subpictus*, Grassi, 83 of *A. vagus*, Dön., 27 of *A. culicifacies*, Giles, 139 of *A. annularis*, Wulp, 70 of *A. aconitus*, Dön., and 7 of *A. varuna*, Iyen. The samples from the treated field contained larger numbers (275 and 176) of *A. subpictus* and *A. vagus*, which are not vectors of malaria, one individual of *A. culicifacies*, two of *A. annularis* and none of the other species.

Hu (S. M. K.). **Studies on the Susceptibility of Shanghai Mosquitoes to experimental Infection with** *Microfilaria malayi* **Brug. IV.** *Culex vorax* **Edwards.**—*Peking nat. Hist. Bull.* **15** pt. 3 pp. 215–216, 3 refs. Peking, 1941.

An account is given of an experiment, similar to others already noticed [*R.A.E.*, B **29** 93, etc.], that was carried out in 1939 in Shanghai to test the susceptibility to infection with *Filaria* (*Microfilaria*) *malayi* of females of *Culex vorax*, Edw., reared from larvae collected locally. Of 18 adults that engorged on a case with a heavy infection, 3 out of 11 dissected 19 days later and 1 out of 7 dissected 23 days later each contained one infective filarial larva. The other 14 mosquitos were negative. None of the infective larvae showed any sign of chitinisation [*cf.* **28** 42], but the fact that only one larva was found in each infected mosquito indicates that it is improbable that this species plays a significant part in the transmission of the parasite under natural conditions in the Shanghai region, where, moreover, the adults are seldom seen in inhabited houses.

[Agrinskiĭ (N.).] **Агринский (Н.). On Ticks as Transmitters of the Horse-nuttalliosis in Middle Asia.** [*In Russian.*]—*Acta Univ. Asiae med.* (8, Zool.) fasc. 31, 9 pp., 3 graphs, 1 ref. Tashkent, 1938. (With a Summary in English.) [Recd. 1941.]

Experiments were carried out in the summer of 1933 in Tashkent to determine whether females of *Dermacentor niveus*, Neum., *Hyalomma marginatum*, Koch, and *Rhipicephalus sanguineus*, Latr., transmit the form of piroplasmosis in horses caused by *Nuttallia equi*. The ticks were taken on horses in a locality where the disease was prevalent, kept for 1–30 days without food, and then placed on healthy foals that had had no previous contact with ticks. No infection was caused by *D. niveus*, though the three examples remained on a foal for 17 days and engorged, but foals on which examples of *R. sanguineus* or *H. marginatum* were allowed to engorge, contracted the disease, *N. equi* occurring in their peripheral blood after incubation periods of 8–14 days.

ROMAN (E.). **Sur quelques moucherons piqueurs de la région lyonnaise appartenant au genre** *Culicoides* **(Diptères, Ceratopogonidés).**—*Bull. Soc. linn. Lyon* **10** no. 3 pp. 38–39. Lyons, 1941.

In view of the transmission of *Filaria* (*Acanthocheilonema*) *perstans* by Ceratopogonids of the genus *Culicoides* [*cf. R.A.E.*, B **16** 155] and a recent case in a hospital in Lyons of a Senegalese severely infested by this parasite, the author gives brief notes on the habits of three species of *Culicoides* that are common in the region of Lyons and have been recorded in the literature as attacking man. These are *C. pulicaris*, L., *C. obsoletus*, Mg., and *C. pumilus*, Winn. (*minutissimus*, Zett.). None of them attacks man at all frequently in this region, and it is considered that they could serve as intermediate hosts for *F. perstans* only under very special conditions.

[KHODUKIN (N.) & SHTERNGOL'D (E.).] **Ходукин (Н.) и Штерногльд (Е.). On the Resistance to Cold of some** *Anopheles*. [*In Russian.*] —*Acta Univ. Asiae med.* (8, Zool.) fasc. 45, 11 pp., 3 graphs. Tashkent, 1938. (With a Summary in English.) [Recd. 1941.]

Laboratory investigations were carried out in Tashkent on the resistance to cold of females of *Anopheles maculipennis* var. *sacharovi*, Favr, *A. superpictus*, Grassi, and *A. pulcherrimus*, Theo. The experimental technique is described, and the results are shown in tables. Previous work in Russia has shown that cold-resistance in insects depends on the amount of fat present in the body, the degree of nutrition and the quantity of fluid in the body that freezes. The last of these factors is largely dependent on the first two. The temperature at which the fluid freezes cannot be taken as an accurate index of cold-resistance, since it is dependent on all three factors. The authors' investigations showed that although females of both *superpictus* and *pulcherrimus* froze at −7·8°C. [17·96°F.] and the percentage of fluid in them that froze was almost the same (24·1 and 24·6, respectively), the percentages of fat in them were 73 and 35; and that although the percentages of fat in females of *sacharovi* and *superpictus* were of the same order (78 and 73), the temperatures at which the mosquitos froze were −18°C. [−0·4°F.] and −7·8°C. and the percentages of fluid that froze were 63·5 and 24·1, respectively. Two of 12 females of *sacharovi* with a developed fat-body survived exposure for 30 hours to a temperature of −20°C. [−4°F.], but all those of *superpictus* and *pulcherrimus* died after exposure for 17 and 20 hours to −9·5 and −7°C. [14·9 and 19·4°F.], respectively.

In Tashkent, females of *A. m. sacharovi* usually hibernate in buildings in which the temperature does not fall below −7°C. [*cf. R.A.E.*, B **19** 52], and recent observations indicate that, in inhabited localities, those of *A. superpictus* usually select similar hibernation quarters. There is therefore unlikely to be any mass mortality among these mosquitos in winter. *A. pulcherrimus* does not hibernate in the adult stage.

In experiments in which eggs of *A. pulcherrimus*, *A. hyrcanus*, Pall., and *A. m. sacharovi* were kept for 16 hours at −4°C. [24·8°F.] those of *sacharovi* did not hatch, whereas those of the other two did so after 48 and 24 hours, respectively. In the controls, the eggs of these mosquitos hatched in 24, 24 and 32 hours, respectively.

[Shterngol'd (E.) & Getzonok (N.).] **Штернгольд (Е.) и Гецонок (Н.). Influence of some Factors upon the Life-cycle of** *Boophilus annulatus calcaratus* **Birula.** [*In Russian.*]—*Acta Univ. Asiae med.* (8, Zool.) fasc. 47, 12 pp., 8 refs. Tashkent, 1938. (With a Summary in English.) [Recd. 1941.]

Laboratory observations on the effect of environment on oviposition by *Boophilus calcaratus*, Bir., which is a vector of piroplasmosis of cattle and is widely distributed in Central Asia [*cf. R.A.E.*, B **25** 241], and on the hatching of the eggs were carried out in Tashkent in the summer of 1933. Female ticks of approximately the same weight were collected from cattle in a slaughter-house and kept in batches of 4 at a temperature of 30 or 18°C. [86 or 64·4°F.] under conditions of darkness or diffused light and a relative humidity of 23–35 or about 100 per cent.

The results, which are given in detail, showed that optimum conditions occurred at 30°C. and about 100 per cent. relative humidity. At 18°C. the preoviposition and oviposition periods were prolonged, and the numbers of eggs laid and the percentage that hatched were reduced. When either temperature was combined with low humidity, all the eggs dried up. The presence or absence of light had little effect.

Gill (D. A.) & Graham (N. P. H.). **Studies on Fly Strike in Merino Sheep. No. 4. The Effect of Fly Strike on Reproduction.**—*J. Coun. sci. industr. Res. Aust.* **13** no. 4 pp. 261–266, 1 fig., 3 refs. Melbourne, 1940. **No. 5. Review of Results obtained by the Mules Operation for the Prevention of Crutch Strike in the Trial at "Dungalear," N.S.W.**—*T.c.* pp. 266–272, 1 fig., 3 refs.

During the trial at Dungalear Station, New South Wales, of the effect of Mules' operation on the infestation of the crutch of Merino sheep by blowflies [*R.A.E.*, B **26** 109; **27** 197], an attempt was made to investigate the effect of strike on fertility and lactation. The low incidence of strike during the investigations and a rather heavy death rate among the lambs prevented the drawing of definite conclusions on several aspects, but such results as were obtained are given in the first paper. They tended to show that B or C class ewes [**28** 103] are not inherently less fertile than A class ewes, and the birthweights of lambs born to ewes of the three classes were quite comparable. The relative number of lambs born and the percentage of ewes in milk were both lower for ewes struck between the beginning of the mating period and the end of lambing than for unstruck ewes, and the percentage that remained dry increased as the number of strikes per ewe (including tail strikes) increased. In an examination of the effect on conception of strike received at different times in relation to mating, an analysis was made of the data referring to ewes struck once only. The percentage of conceptions among ewes struck during the mating period was lower than among those struck before or after, but the number involved was too small for any conclusion to be drawn. By calculating the date of mating from individual lambings, it was found that several ewes were struck less than six days before or after, conception. There was no evidence that strikes tended to delay service or conception. The relative numbers of lambs produced by ewes on which Mules operation had been performed and by untreated

ewes was practically the same. However, during the greater part of the mating season, the strike incidence, which was low in both groups, was very similar, because crutch strikes among the untreated group were controlled by crutching in early June, whereas the treated group were not crutched at this time.

In the second paper, the results obtained in the experiment on the effectiveness of Mules' operation in preventing crutch strike, which ended in April 1940, after having been in progress for two years and nine months, are reviewed. The untreated sheep tended to become plainer in the breech area as they grew older. This may have been partly responsible for the fact that the incidence of strike in the last 18 months of the trial was lower than in the first 14 months, and may also explain in part the fact that young sheep are in general more susceptible to strike than older ones [**29** 51]. The operation reduced the incidence of true crutch strike by 93 per cent. and of strikes involving both crutch and tail by 89 per cent. Of the total of 123 strikes involving the crutch in the treated group, 49 were incurred on two occasions of very short duration, one when the animals were scouring following a rapid growth of pigweed and another when they had not been crutched for seven months and rain following a long dry period suddenly favoured fly activity. Even under these conditions, however, there were over three strikes among the control sheep for every one among the treated ones. The incidence of tail strike increased as the length of the wool on the tip of the tail increased. Crutching gave a high degree of protection from tail strike until the wool had grown again, but susceptible sheep were often struck on the crutch even when the wool was very short. The value of the operation for B class sheep which has often been questioned, was examined, and treatment was found to reduce true crutch strikes in the relatively plain B class ewes by 86 per cent. During the course of the trial, strikes occurred during every month of the year, but the incidence was greatest in spring and autumn. The periods of freedom or comparative freedom from strike lasted up to 3½ months in summer and 1 month in winter. Considerable periods with a mean shade temperature over 82° or under 51°F. seemed to eliminate strike irrespective of rainfall. In the more temperate periods, rains were almost invariably followed by strike.

SPENCER (G. J.). **The Control of Human Lice under War Conditions.**—*Canad. Ent.* **73** no. 1 p. 20. Guelph, Ont., 1941.

The author reports that, during the war of 1914–18, he found that lavender oil rubbed on the ankles, neck, wrists and waistline, deterred body lice [*Pediculus humanus*, L.], and that application of the oil to lice in the seams of clothing killed them very rapidly. Derris powder, dusted and rubbed into the seams of all underwear and uniforms controlled body lice among men recruited in Canada in the present war and caused no irritation. The mosquito repellent Sta-way, which contains diethylene glycol monobutyl ether acetate and diethylene glycol monoethyl ether [*R.A.E.*, B **29** 65], applied with a piece of cotton wool or a shaving brush so as to reach the roots of the hair, gave satisfactory control of the crab louse [*Phthirus pubis*, L.], causing the parasites to loosen their hold and fall off within a few seconds and to die very shortly. It had no ill effect on tender skin.

SABROSKY (C. W.). **The *Hippelates* Flies or Eye Gnats : Preliminary Notes.**—*Canad. Ent.* **73** no. 2 pp. 23–27. Guelph, Ont., 1941.

The flies of the genus *Hippelates* are of medical interest because of their relation to the transmission of epidemic eye diseases [*R.A.E.*, B **17** 99; **19** 60; **21** 242] and yaws. The publication of a comprehensive, illustrated monograph of the group in the western hemisphere is contemplated by the author, but these preliminary notes have been written in order to make certain names and other information immediately available. They include a provisional key to the species occurring in the United States, descriptions of four new ones, and notes on the synonymy of various species, some of which do not occur in that country, including *H. illicis*, Curr., which is considered a synonym of *H. apicata*, Mall., and *H. pallipes*, Lw., and *H. flavipes*, Lw., which are shown to be distinct, the former occurring in the eastern United States and Canada from Maine and Quebec westward to South Dakota and south to the Gulf, and the latter from the Bahamas and Central Mexico southwards throughout the West Indies and Central and South America to Paraguay and southern Brazil, so that it is the form studied in Jamaica [and St. Lucia] as the vector of yaws [**24** 37, 219; **25** 64, etc.].

SWEETMAN (H. L.). **Tests for Toxicity of Arsenicals and Sodium Fluoride to the American Roach, *Periplaneta americana* L.**—*Canad. Ent.* **73** no. 2 pp. 31–34, 8 refs. Guelph, Ont., 1941.

Sodium fluoride has long been recommended for the control of cockroaches and has been assumed to act chiefly as a stomach poison, though there is apparently no published evidence that it does so and it has recently been shown to penetrate the integument to some extent [*R.A.E.*, A **22** 100] as also does arsenic [A **24** 81]. In this paper, descriptions are given of methods used to test the toxicity to *Periplaneta americana*, L., of contact poisons by sealing the mouthparts to prevent ingestion of any of the poison, and of stomach poisons that are normally avoided by passing the head of the insect through a hole in a paper, which is then wrapped round it to prevent escape, and placing a little of the poisoned food on the mouthparts. The cockroach will then usually chew and swallow it, perhaps as a result of avoiding reactions. These methods were used for 3 years in classwork and typical sets of results are given. Sodium fluoride and three arsenicals (Paris green, calcium arsenate and lead arsenate) killed cockroaches by contact action, the toxicities of the arsenicals being related to their recognised solubilities, and sodium fluoride definitely acted as a stomach poison. The first evidence of deleterious action of sodium fluoride, whether administered as a contact or stomach poison, was loss of function of the tarsi.

DAVIS (G. E.). **Ticks and Relapsing Fever in the United States.**—*Publ. Hlth Rep.* **55** no. 51 pp. 2347–2351, 23 refs. Washington, D.C., 1940.

The history of tick-borne relapsing fever in the United States is briefly reviewed from the literature, and a table is given showing the 17 States in which ticks of the genus *Ornithodorus* are known to occur, and the presence or absence of relapsing fever, the vector if known, and the species of *Ornithodorus* in each. Tick-borne relapsing fever is

present in 11 States, in all of which ticks of the genus *Ornithodorus* occur. The known vectors are *O. turicata*, Dugès, in Texas and Kansas, and *O. hermsi*, Wheeler, in California, Colorado and northern Idaho. *O. parkeri*, Cooley, is the only known species in a large area from which 17 cases have been reported. Spirochaetes have been recovered from *O. talaje*, Guér., collected in Arizona and from *O. parkeri* collected in Wyoming, Montana and Utah. The only other species of the genus recorded from the United States are *O. coprophilus*, McIntosh, and *O. coriaceus*, Koch [but *cf. R.A.E.*, B **28** 245]; R. A. Cooley has found that *O. wheeleri*, McIvor [**26** 24] is a synonym of *O. parkeri*.

Mazzotti (L.). *Ornithodoros coprophilus* **McIntosh, en el estado de Chiapas, México.**—*Ciencia* **1** no. 9 pp. 405–406, 3 refs. Mexico, D.F., 1940.

Ornithodorus coprophilus, McIntosh, was observed in Chiapas on the dung on the floor of a cave harbouring numerous bats [*cf. R.A.E.*, B **28** 197]. The ticks were very abundant on the dung, but none was found on the bats and individuals placed on a bat for over an hour failed to feed.

Senior White (R.) & Adhikari (A. K.). **On Malaria Transmission in the eastern Satpura Ranges.**—*J. Malar. Inst. India* **3** no. 4 pp. 383–411, 1 map, 1 graph, 5 refs. Calcutta, 1940.

The investigation reported in this paper on malaria transmission in the eastern Satpura Ranges (an area lying roughly between 79° 45′ and 82° 5′ east and 21° 30′ and 22° 35′ north) was carried out from September 1936 to April 1940 at thirteen stations. The problem of malaria transmission in the Central Provinces, which were known to include both epidemic and endemic malarial areas, had previously been untouched for over 20 years. In 1914, a list of the Anophelines of the province was published by W. H. Kenrick; adapted to modern synonymy, it is as follows: *Anopheles barbirostris*, Wulp, *A. hyrcanus* var. *nigerrimus*, Giles, *A. culicifacies*, Giles, *A. fluviatilis*, James, *A. aconitus*, Dön., *A. jeyporiensis*, James, *A. subpictus*, Grassi, *A. turkhudi*, List., *A. splendidus*, Koidz., *A. tessellatus*, Theo., *A. stephensi*, List., *A. maculatus*, Theo., *A. theobaldi*, Giles, *A. jamesi*, Theo., *A. annularis*, Wulp, and *A. pallidus*, Theo. All these were found in the authors' investigation with the exception of *A. turkhudi* and with the addition of *A. varuna*, Iyen., which was not distinguished until 1924, *A. minimus*, Theo., *A. vagus*, Dön., and *A. karwari*, James. *A. culicifacies* was the dominant species everywhere on the year's totals, though the numbers fell off considerably after August. However, only 0·09 per cent. of the total number of this species dissected had gut infections, and only 2 individuals or 0·02 per cent. had gland infections. In one known epidemic area in which an infective individual was found in September 1939, there was a severe outbreak caused by *Plasmodium falciparum* in that year, following a year of unusually high incidence. From 1932, work there had been directed against all possible vectors for five years, and though the results were never completely satisfactory, malaria decreased steadily until 1937. In 1938, it was decided to restrict control to the *funestus* group (*fluviatilis*, *varuna* and *minimus*) in feral breeding places, except for continuing to treat the wells so far as possible. However, following the finding of sporozoites in

A. culicifacies at another station in October 1938, control measures against this species were resumed. It was not found infected locally during this season of high malaria incidence and was disregarded in the control programme for 1939, but after sporozoites had been found in it in September, its control was resumed for the rest of the season, without, so far as can be judged, cutting short the outbreak to any extent. It is concluded that it was not of any importance in this epidemic [*cf. R.A.E.*, B **26** 233 ; **29** 71] in which the vector remains unknown.

A. fluviatilis was a vector, with the high sporozoite rate typical of hyperendemic conditions, at all but three of the localities studied. Of the females dissected, 4·4 and 2·8 per cent. had gut and gland infections, respectively. The corresponding figures for *A. varuna* were 4·0 and 3·7. This species was only one-third as plentiful in house catches as *A. fluviatilis*, and in five localities it was not found infected. Only two individuals of *A. minimus* were taken, and neither was infected. *A. annularis* and *A. pallidus* were the only other species found infected, and though they had appreciable oöcyst rates, neither had any sporozoites. The former occurred only late in the season and not in very large numbers ; the latter occurred in considerable numbers from July until the end of the year, but is not thought to play any part in spreading malaria. The percentage of *A. fluviatilis* and *A. varuna* among the total taken varied from 0·5 in one locality to 46·1 in another in thick forest. The average percentage was only 8·3, as compared with 22·7 in the Jeypore Hills and 33·4 in the Singhbhum Hills, apparently because both species rest by day much less frequently in houses in the Satpuras than in the hill massifs further east. Although the vectors of the *funestus* group are associated generally with hyperendemic rather than with epidemic malaria, there appear to be definite fluctuations in house density of *A. fluviatilis* and *A. varuna* in the Satpuras from year to year.

Senior White (R.) & Appal Narayana (P.). **On Malaria Transmission in the Singhbhum Hills. Part II. An Experiment with Trap-nets.** —*J. Malar. Inst. India* **3** no. 4 pp. 413–425, 3 refs. Calcutta, 1940.

In an attempt to confirm previous conclusions on the importance of Anophelines of the *funestus* group (*Anopheles fluviatilis*, James, *A. varuna*, Iyen., and *A. minimus*, Theo.) in the transmission of malaria and its seasonal incidence in the Singhbhum Hills [*R.A.E.*, B **26** 233], two double net traps with human bait [*cf.* **21** 147] were set up out of doors and used from May 1939 to April 1940. One was situated at a railway station at the centre of a protection circle for the *funestus* group with a radius of $\frac{3}{4}$ mile, and the catch from it was locally identified and recorded. Here, a reduction of staff in 1938 and 1939 was accompanied by an unexplained increase in malaria in spite of increased efficiency of control. Of the 334 Anophelines caught on 133 days, 126 were *A. culicifacies*, Giles, 28 *A. fluviatilis* and 12 *A. minimus* ; no example of *A. varuna* was taken. The catches from the other net, situated about one mile away, were sent to Calcutta daily for dissection. The total catch of 1,268 Anophelines included 236 *A. culicifacies*, 81 *A. fluviatilis*, 124 *A. minimus* and 153 *A. varuna*. Of these, 1, 1, 12 and 8 had gut infections and 0, 1, 7 and 3 had gland infections, respectively. No infected individuals were found among the other species. No Anophelines were taken between March and

June. Members of the *funestus* group appeared in very small numbers in July, but were not present in any quantity until towards the end of August. The first oöcysts were found, in *A. minimus*, in the last week of August, and the first sporozoites, in *A. varuna*, in the first week of September. The last sporozoites were found, in *A. fluviatilis*, in mid-November, though oöcysts were found in this species in the following week and in *A. varuna* in the first week of December. By this season, the Singhbhum Hills have quite a low night temperature, and transmission appears definitely to stop, as, though quite heavy catches of the vectors continued until the end of December, no further infected individuals were found. While *A. culicifacies* constituted 44·1 per cent. of the catches in houses recorded in the previous paper in this series [**26** 233], it formed only 23·2 per cent. of the catch in the net in the uncontrolled area, while the corresponding percentages for the *funestus* group were 42·5 and 35·2. This indicates that nearly all the females of the *funestus* group that enter dwellings do so in order to obtain food, whereas little more than half those of *A. culicifacies* that enter dwellings do so for this reason. The ratio of *A. fluviatilis* to the total catch was three times as great in houses as in the net, while the opposite was the case with *A. varuna*.

Russell (P. F.) & Ramanatha Rao (H.). **The *Anopheles* of Ricefields in South-eastern Madras.**—*J. Malar. Inst. India* **3** no. 4 pp. 427–446, 5 pls., 1 graph, 3 refs. Calcutta, 1940.

This paper contains the results of observations made between June 1937 and December 1938 on Anopheline breeding in rice-fields and channels in an irrigated area (Pattukkottai taluk) in south-eastern Madras [*cf. R.A.E.*, B **27** 44, 152]. A brief account of the procedure of rice culture is included. Larvae of ten species of *Anopheles* were collected in the rice-fields [*cf.* **29** 9]. These were *A. annularis*, Wulp, *A. barbirostris*, Wulp, *A. culicifacies*, Giles (which is the local vector of malaria), *A. hyrcanus* var. *nigerrimus*, Giles, *A. jamesi*, Theo., *A. pallidus*, Theo., *A. subpictus*, Grassi, *A. tessellatus*, Theo., *A. vagus*, Dön., and *A. varuna*, Iyen. Nine species were taken in fallow fields, the commonest being *A. subpictus*, *A. culicifacies* and *A. pallidus*, with densities (expressed as average number of larvae caught per minute) of 1·25, 0·61 and 0·44, respectively. It is estimated that a density of 0·10 of *A. culicifacies* is of practical importance. The total Anopheline density and the density of *A. culicifacies* were highest (3·92 and 1·18) when the fields were newly watered before ploughing. Agricultural operations, mainly ploughing, reduced the density of larvae through the year, presumably not by mechanical action, but by bringing about ecological changes unfavourable to the larvae. Studies not yet complete indicated that there was less breeding of *A. culicifacies* when fields were allowed to remain fallow after the normal planting time and developed more vegetation. Only six species were collected in rice nurseries, *A. pallidus* being much the most numerous with a density of 1·22, rising to 1·58 when the seedlings were 4–6 inches tall. *A. culicifacies* had a density of only 0·23. All ten species were collected in fields of growing rice. Density was greatest (5·91) when the crop was planted and least (0·87) just before harvest. The most common species was *A. h. nigerrimus* with a density of 0·59. *A. pallidus* and *A. culicifacies*, which had total densities of 0·57 and 0·08, started with about equal densities (0·49

and 0·42), but while the former and *A. h. nigerrimus* increased in numbers for a time, the latter steadily decreased, its density being 0·06 when rice stood 12–15 inches above the surface of the water and 0·002 at harvest. Delayed planting experiments suggested that distribution and density of species in rice-fields depended on the stage of the rice, and not on the season of the year. When given a choice, females appeared to avoid ovipositing among plants more than 12 inches high.

Larval density was greater in the absence of macroscopic masses of green and blue-green algae. Some preliminary output studies made over a period of nearly 6 months suggested that the proportion of larvae in rice-fields to survive parasites and predators is surprisingly low, the adult output averaging only 4·3 per cent. of the estimated larval populations. The highest output of larvae and adults was in newly transplanted fields and the lowest in growing rice less than 12 inches tall; the output of larvae was equally low in the flowering stage, but that of adults was higher and formed a larger percentage (7·6) of the larval population than at any other time. In experiments with intermittent irrigation in which periods of 5 wet days alternated with 1, 2, 3 or 4 dry ones, it appeared that, except during periods of daily rains, output of adults could be prevented by cycles of 5 wet and 2 or more dry days. However, in view of the local rapidity of larval development, a safer cycle would be 4 wet days and at least 3 dry. Some experiments in which rice was planted in field channels, which are prolific sources of Anophelines, including *A. culicifacies*, suggested that, without significantly obstructing flow, this might control the breeding of *A. culicifacies* after the plants were 12 inches, or more, above the water surface. Total Anopheline breeding also was reduced considerably, though *A. h. nigerrimus* and *A. pallidus* tended to increase.

Chopra (R. N.), Roy (D. N.) & Ghosh (S. M.). **Action of Pyrethrum on Mosquito Larvae.**—*J. Malar. Inst. India* **3** no. 4 pp. 457–463, 16 refs. Calcutta, 1940.

In experiments in Bengal, Indian-grown pyrethrum as a coarse powder killed larvae of *Anopheles subpictus*, Grassi, *A. stephensi*, List., *Culex fatigans*, Wied., *Aëdes aegypti*, L., and *Armigeres obturbans*, Wlk., within 24 hours in the laboratory when sprinkled in small quantities on the surface of the water containing them, but its action on the pupae was feeble. It killed small fish more quickly than Anopheline larvae. An aqueous extract prepared by boiling the coarse powder in water for 3–4 minutes gave good control of pupae as well as larvae under laboratory conditions, and its potency remained unimpaired after storage in a glass jar exposed to the light for three days. Mosquito larvae were also killed by the solid residue filtered from an extract prepared in this way. The authors consider that this is due to the fact that pyrethrins I and II are insoluble in water, and that the toxicity of the aqueous extract indicates that pyrethrum also has other insecticidal constituents. Neither the extract nor the powder had any effect on Anopheline eggs. Coarsely prepared powder of Kenya pyrethrum that had been stored in an opened tin for five years effectively destroyed larvae of *C. fatigans* in field trials in vats at tanning factories, but had very little effect on *Anopheles subpictus*. It failed to reduce appreciably the abundance of *Armigeres obturbans*, larvae of which

were present in the vats in millions, although it killed large numbers of them within 24 hours. The concentration of pyrethrum was considerable, and the unsatisfactory results, as compared with the laboratory tests, cannot be explained.

Home-made kerosene extract of pyrethrum, prepared by soaking 1 oz. Kenya pyrethrum in 18 oz. kerosene for 24 hours, proved efficient against larvae and pupae of *Culex fatigans* in the field when the supernatant fluid was used at the rate of 3 oz. for 20 ft. of drain 2½ ft. broad and 1 ft. deep. It is thought that the good results were attributable to the breaking up of the kerosene into minute droplets by the sprayer used, and to the active principles of the pyrethrum. The action of kerosene on mosquito larvae and its spreading power are greatly enhanced by the addition of the pyrethrum.

In further experiments, the results of which are shown in a table, kerosene extracts of pyrethrum from which the pyrethrins had previously been completely extracted, and also kerosene extracts of the residues from these, killed stated percentages of adult mosquitos and flies of various species. Apparently, the toxicity of the kerosene alone was not tested. These experiments are considered to prove conclusively that the pyrethrins are not the only toxic constituents of pyrethrum. Moreover, an extract of *Chrysanthemum* (*Pyrethrum*) *cinerariaefolium* diluted with kerosene to contain 225 mg. pyrethrins per 100 cc. of the mixture, gave complete kill of mosquitos, while an extract of *C.* (*P.*) *roseum* similarly diluted to contain 400 mg. gave only 84 per cent. kill.

MONDAL (R. S.). **The Species Control of a Hill-stream by training.**—*J. Malar. Inst. India* **3** no. 4 pp. 465–474, 1 pl., 2 refs. Calcutta, 1940.

For about 1½ miles of its course, the Sandyl River, which rises in the Jeypore Hills, and flows northwards to join one of the principal tributaries of the Mahanadi, flows through a malaria protection area where the vectors are *Anopheles fluviatilis*, James, *A. varuna*, Iyen., and *A. minimus*, Theo. [*R.A.E.*, B **25** 191]. The area was extended to include this stretch of river in June 1934. In the length under consideration, it is an almost perennial stream, which in dry weather flows slowly in a bed between vertical high earth banks forming the flood season margins. Some training of a stream of this type is necessary before it can be oiled, and it was observed when this had been done that breeding before oiling was very much less in the trained than in the untrained length of the stream. As a result of this observation, investigations on the effect of training were carried out between 1937 and February 1940. The results for the trained length were obtained without any application of oil when training was in order, but in January, when it was in progress, and when it was being damaged by the first monsoon showers in June, some oiling was necessary. In all, larvae of 18 species of *Anopheles* were taken. Though the amount of breeding differed greatly in the seasons 1938–39 and 1939–40, the proportion of the vector group in the total catch was remarkably constant, at least from September to February. In the untrained stream outside the protection area, practically all the breeding of vectors occurred among tree-roots and along grassy margins. Breeding among boulders or along sandy margins was almost confined to *A. culicifacies*, Giles, and *A. maculatus*, Theo., and *A. theobaldi*, Giles,

the larvae of which are indistinguishable. In the trained length, vectors bred almost exclusively between June and December, when training is impossible owing to floods. It is suspected that, at the start of the rains, larvae are washed down into the protected area from outside. A boom to prevent larval drift was placed at the upstream limit of the area, but in sudden spates, some larvae probably escape around it on account of the increased volume of water. Outside the protected area, *A. varuna* comprised 29·5 per cent. of the larvae of the vector group found among roots and grass and was not represented among the small number found among boulders or against sand, whereas in the trained length of stream, it comprised almost exactly half the catch of vectors, and all except two individuals were taken between May and December. It is thought that it prefers stagnant or slowly moving water and the other two species a definite flow. In May, there is virtually no water and, therefore, no current, and the rest of the period comprises the flood season when breeding can only take place out of the current. The incidence of clinical malaria suggests that transmission in the area occurs from June to March so that training is profitable even though it cannot be begun until January. No improvement in health can be attributed to the inclusion of the river in the controlled area since 1934, as any reduction in the production of malaria vectors was offset by the increased breeding in rice-fields.

CHOPRA (R. N.), ROY (D. N.) & GHOSH (S. M.). *Blumea densiflora* **and** *Artemisia vulgaris*: **their Insecticidal and Larvicidal Properties.** —*J. Malar. Inst. India* **3** no. 4 pp. 495–498, 3 refs. Calcutta, 1940.

In the course of routine investigations on the effectiveness of various Indian plants reputed to have insecticidal properties, extracts of the leaves of *Blumea densiflora* and *Artemisia vulgaris* prepared in various ways were tested against mosquito larvae and adult Diptera. Neither showed any high degree of toxicity, but *A. vulgaris* was slightly the more effective, particularly when used in the form of the essential oil extracted by steam distillation.

ROY (D. N.). **A Study of the Bionomics of** *Anopheles subpictus* **and** *Anopheles annularis*.—*J. Malar. Inst. India* **3** no. 4 pp. 499–507, 6 figs., 9 refs. Calcutta, 1940.

The main results of these studies carried out in Calcutta, in which it was found that *Anopheles subpictus*, Grassi, differs from *A. annularis*, Wulp, and *A. stephensi*, List., in that it will not mate in cages and the development of eggs in virgin females fed on blood does not proceed beyond the stage of follicular stimulation, have already been noticed [*R.A.E.*, B **28** 167]. It was found that the amount of blood ingested by all three species in the wild state is greater than in the laboratory. The development of eggs in them is marked by four stages, *viz.*, complete filling of the ovum with yolk granules, elongation of the ovum, appearance of floats, and hardening of the cuticle. Each occupies about 24 hours, so that maximum development is attained in four days. One individual of *A. annularis* was induced to oviposit on the fourth night. The maturation of the second batch of eggs in this species also took four days. Anopheline eggs, like those of *Culex fatigans*, Wied.

[**28** 94], undergo some increase in size after they are laid, due to absorption of water. *A. subpictus* commonly takes a second blood-meal before eggs are laid, but such blood does not appear to nourish the second batch of eggs and most of it is wasted. From a study of the progress of follicular development, it is surmised that *A. subpictus* fed at all times of the night and *A. annularis* mostly during the first part. Nearly 99 per cent. of the females of *A. annularis* taken were found to have paired before they were caught, while a large proportion of *A. subpictus* caught indoors were virgin, though they had taken a blood-meal.

VENKAT RAO (V.) & RAMAKRISHNA (V.). **A Note on the Larva of** *A. varuna* **(Iyengar).**—*J. Malar. Inst. India* **3** no. 4 pp. 509–512, 8 refs. Calcutta, 1940.

The authors studied several hundred larvae of *Anopheles varuna*, Iyen., from North-east and East Central India and conclude that the differences between them and those described by Roy [*cf. R.A.E.*, B **27** 43] on the one hand and the larvae from South India as described by Puri [**19** 227] on the other are not sufficient to warrant varietal status for the latter. A modification of Roy's description made to apply to individuals from the whole of East Central India is given. The larvae examined were taken in clear and turbid standing and running water, with and without aquatic vegetation and overhanging shade.

RUSSELL (P. F.) & RAMACHANDRA RAO (T.). **Natural Malaria Infections in some South Indian Anophelines, with special Reference to** *A. culicifacies*.—*J. Malar. Inst. India* **3** no. 4 pp. 543–562, 28 refs. Calcutta, 1940.

Over 36,000 Anophelines from Pattukkottai in south-eastern Madras were dissected and analysed for malaria infection between November 1936 and January 1940 inclusive [*cf. R.A.E.*, B **27** 44, 208]. They represented 11 species and included 13,156 females of *Anopheles culicifacies*, Giles, 13,277 of *A. subpictus*, Grassi, and 6,874 of *A. vagus*, Dön. These three species were the only ones found infected and had infection indices of 0·106, 0·015 and 0·015 per cent., respectively, though a few of the mosquitos were not examined for both oöcysts and sporozoites. Their oöcyst indices were 0·073, 0·016 and 0 per cent., and their sporozoite indices 0·061, 0·008 and 0·015 per cent., respectively. The infection rate for *A. culicifacies* taken in human dwellings was 0·13 per cent. as compared with 0·09 per cent. for those taken in cattle-sheds and 0·08 per cent. for those taken in buildings housing man and cattle. The findings are compared with those of other workers in other parts of India. From an analysis of infection indices by months, it appears that transmission occurred only when irrigation was being practised, but the numbers dissected in some months were not great enough to provide conclusive evidence. Meteorological conditions in Pattukkottai, which are discussed in relation to the findings, would appear to permit of infection in any month. There was no correlation between temperature and infection, nor between total infections and either relative humidity or saturation deficiency, but there seemed to be a tendency towards decreased sporozoite infections as relative humidity became less or saturation

deficiency greater. The peak of infectivity was in the third quarter of the irrigation season, in October and November. Before irrigation was begun in 1933–34, malaria was practically unknown in the area.

The indices of relative potential danger [**24** 259] were found to be 0·106 for *A. culicifacies*, 0·061 for *A. subpictus* and 0·017 for *A. vagus*, and it is concluded that *A. culicifacies* is the chief vector, little importance being attached to the isolated infections found in the other two species. Indices of infective density [**21** 131] were calculated for *A. culicifacies* for two-monthly periods, ignoring "x," as this species tends to remain indoors throughout the hours of daylight, and taking the total infection index instead of the sporozoite index, as observation indicated that once an individual of this species was infected, development of the *Plasmodium* to the infective stage was probable. There was considerable seasonal variation in the indices, which were nil during the non-irrigation period from February to May and 0·00286, 0·00684, 0·00756 and 0·00207 in the four quarters of the irrigation season. Interpreted in terms of dwellings per single infected mosquito, there was one infected female per 350, 146, 132 and 483 dwellings in the four quarters. In spite of its low infection indices, *A. culicifacies* is maintaining average endemic spleen and parasite indices of over 40 and 30 per cent., respectively. The validity of Senior White's conclusion that it plays no part in malaria transmission in the Jeypore Hills [**25** 191] or the Singhbhum Hills [**26** 233 ; **29** 146] is questioned. Too little attention is thought to have been paid to the questions of density of insect and human carriers, and it is suggested that large increases in the density of this Anopheline at certain seasons may explain how a weak carrier can maintain an endemic index and precipitate seasonal, and even fulminant, epidemics.

Papers noticed by Title only.

Takahasi (H.). **Description of five new Species of Simuliidae from Manchoukuo. (Studies on Simuliidae of Manchoukuo, I.)**—*Insecta matsum.* **15** no. 1–2 pp. 63–74, 7 figs., 7 refs. Sapporo, 1940.

Bequaert (J.). **Moscas parásitas pupíparas de Colombia y Panamá (Contribución a la parasitologia).** [Hippoboscids, Nycteribiids and Streblids of Colombia and Panama.]—*Rev. Acad. colomb. Cienc.* **3** no. 12 pp. 414–418. Bogotá, 1940.

Philip (C. P.). **Comments on the Supra-specific Categories of Nearctic Tabanidae (Diptera).**—*Canad. Ent.* **73** no. 1 pp. 2–14, 8 refs. Guelph, Ont., 1941.

Cooley (R. A.) & Kohls (G. M.). *Ornithodoros viguerasi*, **a new Species of Tick from Bats in Cuba (Acarina : Ixodoidea).**—*Publ. Hlth Rep.* **56** no. 9 pp. 396–399, 1 pl., 5 figs. Washington, D.C., 1941.

Cooley (R. A.) & Kohls (G. M.). **Three new Species of** *Ornithodoros* **(Acarina : Ixodoidea).** [*O. eremicus* from *Peromyscus*, *O. stageri* from bat-inhabited caves and mines, and *O. yumatensis* from bats and bat-caves, all in the United States.]—*Publ. Hlth Rep.* **56** no. 12 pp. 587–594, 2 pls., 9 figs. Washington, D.C., 1941.

RUSSELL (P. F.) & KNIPE (F. W.). **Malaria Control by Spray-killing Adult Mosquitoes. Second Season's Results.**—*J. Malar. Inst. India* **3** no. 4 pp. 531–541, 2 pls., 7 refs. Calcutta, 1940.

The results obtained in a village in southern India in an attempt to control malaria by spraying against mosquitos in their day-time resting places [*R.A.E.*, B **28** 92] were confirmed in a second season's work carried out between 18th June 1939 and 15th January 1940. The only significant modification of technique was the systematic spraying of the outside of each house under the eaves before the house was entered. This seemed to prevent the mosquitos from leaving the building. Data regarding population, number of houses, area and space sprayed and cost are given in tables. Spraying did not have much effect on the total monthly average number of larvae of *Anopheles culicifacies*, Giles, per collection, but there seemed to be some effect on man-hour collections of adults of this species, and spleen and parasite rates revealed a definitely beneficial effect. The spleen rates in the treated and control villages in November 1939 were 14·4 and 57·4 per cent., respectively, and the corresponding parasite rates were 6·2 and 47·5 per cent. Spleen and blood indices were lower in persons living in houses sprayed twice a week than in those living in houses sprayed once. The decrease in spleen size [*loc. cit.*] also continued. A parasite survey among infants not over one year old, made in January and February 1938 as a measure of transmission during the malaria season of June 1937 to January 1938 showed parasite indices of 12·5 per cent. in the treated village and 21·4 per cent. in the control, but a similar survey in February 1940 showed corresponding indices of 0 and 22·7 per cent. It is concluded that, though too expensive for a village, the method appears to have great value for estates and government undertakings. Some preliminary experiments in another village with a slightly different technique indicate that the cost can be reduced by improvements in the sprayer mechanism.

AITKEN (T. H. C.). **The Genus *Psorophora* in California (Diptera, Culicidae).**—*Rev. Ent.* **11** fasc. 3 pp. 672–682, 3 figs., 10 refs. Rio de Janeiro, 1940.

Records are given of the finding of adults and larvae of a species of *Psorophora* in California and Arizona. The larvae were found from May onwards in irrigation overflow pools [*cf.* also *R.A.E.*, B **27** 257], and the adults occur from June to December and may cause considerable annoyance. Their identification was rendered difficult by the fact that Dyar [**16** 167] separates four closely allied species solely by regional distribution and the characters of the male genitalia (number of claspette setae), *viz.*, *P. confinnis*, Lynch, from South America, *P. columbiae*, D. & K., from the eastern United States, *P. jamaicensis*, Theo., from the West Indies, and *P. tolteca*, D. & K., from Mexico. Examination was therefore made of adults obtained from Arkansas, California, Mexico, Costa Rica, St. Croix, and Peru and of larvae from most of these places, and no characters distinguishing them were found, the number of claspette setae being variable. It is concluded that the four names apply to a single, widely distributed species, *P. confinnis* being the earliest. The adults of both sexes and larvae are described from the Californian material.

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PICKEL (D. B.). **Dermatite purulenta produzida por duas especies de *Paederus* (Col. Staphylinidae).** [Purulent Dermatitis produced by two Species of *Paederus*.]—*Rev. Ent.* **11** fasc. 3 pp. 775–793, 59 refs. Rio de Janeiro, 1940. (With a Summary in English.)

There are 20 species of *Paederus* in Brazil, but only 6 of them are notoriously vesicant. In the world literature, 16 species with vesicant properties have been recorded, but it is probable that all the species are toxic to a more or less extent. The clinical facies of the dermatitis they cause seems to have the same aspect in all parts of the world. The author has found that *P. ferus*, Er., and *P. brasiliensis*, Er., cause dermatitis in Pernambuco, and gives a detailed account of the symptoms they produce.

LENT (H.) & MARTINS (A. V.). **Estudos sobre os Triatomideos do Estado de Minas Gerais, com descrição de uma especie nova.** [Studies on the Triatomids of the State of Minas Gerais, with a Description of a new Species.]—*Rev. Ent.* **11** fasc. 3 pp. 877–886, 2 pls., 1 fig., 4 refs. Rio de Janeiro, 1940.

A description is given of the female of *Triatoma arthurneivai*, sp. n., from the State of Minas Gerais, Brazil, together with a list of the other 12 Triatomids that occur there, showing their local distribution and, in some cases, habitats and animal hosts.

DA FONSECA (F.) & RAMOS (A. S.). *Shannonesia* **nov. nom.** (**Dipt. Culicidae**).—*Rev. Ent.* **11** fasc. 3 p. 966. Rio de Janeiro, 1940.

Shannonesia is proposed for *Shannoniella*, Fonseca & Ramos, a subgenus of *Anopheles* [*R.A.E.*, B **28** 220], which is preoccupied by *Shannoniella*, Townsend, 1939.

CLAPHAM (P. A.). **Three new intermediary Vectors for *Syngamus trachea*.**—*J. Helminth.* **17** no. 4 pp. 191–192, 2 refs. St. Albans, 1939. [Recd. 1941.]

Larvae of *Syngamus trachea* have recently been found in England in a centipede of the genus *Scolopendra*, larvae of a species of *Tipula* and the Collembolan, *Smynthurus* (*Sminthurus*) *viridis*, L. All the infected examples of these Arthropods were taken on land carrying a heavy population of the Nematode, and in each case the larvae of the latter had migrated from the gut and settled in the surrounding tissues. It is probable that *Smynthurus* frequently acts as a transmitting agent of gapeworm disease in the case of game birds, as young partridge chicks consume enormous numbers of this springtail. The Nematodes were found in five out of seven Tipulid larvae examined and the latter each contained 13–35 larvae, but they are possibly of less importance in the transmission of the disease since their size makes them unlikely to be eaten by small chicks. The adults may often serve as food for birds and may, therefore, be of importance as a reservoir of infection if it persists in them, as it does in Muscoid flies [*R.A.E.*, B **28** 96].

WIGGLESWORTH (V. B.). **The Effect of Pyrethrum on the Spiracular Mechanism of Insects.**—*Proc. R. ent. Soc. Lond.* (A) **16** pt. 1–3 pp. 11–14, 2 figs., 9 refs. London, 1941.

The following is the author's summary: The destructive action of pyrethrum on the central nervous system of insects is confirmed.

But it is shown that in *Rhodnius prolixus*, Stål, there is little or no increase in evaporation from insects paralysed with pyrethrum until after death ; and that in paralysed *Cimex lectularius*, L., the spiracles are kept closed and still react to carbon dioxide. Desiccation cannot therefore be the main cause of death after pyrethrum poisoning.

NAUCK (E. G.) & ZUMPT (F.). **Versuche zur Uebertragung des murinen Fleckfiebers durch die Bettwanze.** [Experiments on the Transmission of Murine Typhus by the Bed-bug.]—*Zbl. Bakt.* (I Orig.) **146** pt. 3 pp. 97–103, 7 refs. Jena, 1940.

An account is given of experiments at Hamburg on the transmission to mice by means of *Cimex lectularius*, L., of a Mexican strain of murine typhus that had been maintained for several years in guineapigs and mice. When a suspension of the brain or peritoneum of infected mice was injected into the body-cavity of normal bugs and suspensions of the latter injected intraperitoneally 1, 8, 13, 14 and 20 days later into uninfected mice, infection resulted in each series. Some of the infected bugs oviposited, but none of the resulting nymphs was infective when fed on mice. When suspensions of bugs that had fed from 15 minutes to 15 days previously on infected mice were injected into healthy mice, the bugs were shown to have retained the infection for up to 6 days, and one case of doubtful infection was obtained after 15 days. No transmission was obtained by allowing bugs into which a suspension from infected mice was injected to feed on healthy mice, by crushing on the shaved skin of mice bugs that had engorged on infected mice, by allowing bugs that had partly engorged on infected mice to complete their meal on healthy ones, or by allowing bugs that had engorged on infected mice to feed on healthy ones 3 and 9 days later. The faeces of bugs that had fed on infected mice 2–8 days previously were not infective and conferred no immunity when injected into healthy mice.

From these experiments and those of Castaneda & Zinsser [*R.A.E.*, B **19** 117], it is concluded that *Cimex lectularius* cannot transmit murine typhus to man.

NIESCHULZ (O.). **Uebertragungsversuche mit einem südeuropäischen Surrastamm und** *Stomoxys calcitrans*. [Transmission Experiments with *S. calcitrans* and a Strain of Surra from southern Europe.]—*Zbl. Bakt.* (I. Orig.) **146** pt. 3 pp. 113–115, 5 refs. Jena, 1940.

The technique of these experiments in 1939 on the transmission to guineapigs and rats by means of *Stomoxys calcitrans*, L., of a strain of *Trypanosoma evansi* isolated from a horse in Bulgaria was similar to that in previous experiments [*cf. R.A.E.*, B **28** 179] and the interruptions in feeding did not exceed a minute. When 17 batches of 10, 25 or 50 flies were removed from infected guineapigs and allowed to complete their meal on healthy ones, infection resulted in two cases, in which the batches contained 10 and 25 flies, respectively. When 9 batches of 10, 20 or 25 flies were transferred from infected guineapigs to healthy rats, infections were produced by four batches of 10, 20, 20 and 25 flies, respectively. Further experiments, in which the

contents of the guts of flies that had fed on infected guineapigs were inoculated subcutaneously into healthy rats, showed that *T. evansi* retained its normal virulence in the fly for at least 24 hours.

LENT (H.) & PIFANO (C. F.). **Sobre a identidade dos generos *Panstrongylus* Berg, 1879 e *Mestor* Kirkaldy, 1904. Redescrição de *Panstrongylus rufotuberculatus* encontrado, na Venezuela, naturalmente infestado pelo *Schizotrypanum cruzi*.** [The Identity of the Genera *Panstrongylus* and *Mestor*. Redescription of *P. rufotuberculatus* found in Venezuela naturally infected with *Trypanosoma cruzi*.]—*Rev. Ent.* **11** fasc. 3 pp. 629–639, 2 figs., 16 refs. Rio de Janeiro, 1940.

The literature on the status of the genera *Panstrongylus* and *Mestor* is reviewed, and the characters supposed by some authors to separate them, notably those employed by Usinger [*R.A.E.*, B **28** 98], are quoted. The results of examination of specimens of 8 and descriptions of 4 species that belong to this generic complex are shown in a table, and it is concluded that some of the characters by which *Mestor* has been differentiated from *Panstrongylus* are variable within individual species, while others overlap between one species and another. *Mestor* is therefore considered congeneric with *Panstrongylus*.

The authors also briefly discuss the distribution of *P.* (*M.*) *rufotuberculatus*, Champ., which occurs in Panama, Venezuela and Ecuador, and give a detailed description of the male based on one specimen from Ecuador and two from Venezuela. One of the latter was collected by them and found to be heavily infected with *Trypanosoma* (*Schizotrypanum*) *cruzi*.

GEORGE (P. V.) & TIMOTHY (B.). **A preliminary Study of Plague at a Hill Station in the Nilgiris, South India.**—*Indian med. Gaz.* **76** no. 3 pp. 142–148, 4 pls., 1 map, 3 graphs, 5 refs. Calcutta, 1941.

Plague first occurred in the Nilgiris district in south-western Madras in 1903. It spread rapidly and has been endemic ever since, and although its incidence has steadily declined, a rough 3–4 year periodicity is discernible. Over half the cases have been occurring in two urban areas, Ootacamund and Coonoor, which comprise only about 2 per cent. of the total area of the district and 25 per cent. of its population. Potatoes are extensively grown, and as field rats abound in the potato farms, an attempt has been made to discourage potato farming round residential areas by municipal legislation. An examination of the situation was made in May–July 1939. The topography and climate of the Nilgiris plateau, which is the smallest district in Madras province in extent and population, are described. The climate is temperate and equable, owing to the high altitude. One of the purposes of the inquiry was to ascertain whether sylvatic plague occurs in the district or whether the prevailing factors are favourable to its onset.

A study was made of 1,019 rodents obtained from various parts of the district and comprising *Mus* (*Rattus*) *rattus* (556), *Bandicota malabarica* (30), *Gunomys kok* (136), *Mus musculus* (271), *Leggada booduga* (13) and *Golunda ellioti* (13) ; and 1,939 fleas, comprising *Xenopsylla astia*, Roths. (178), *X. brasiliensis*, Baker (514), *X. cheopis*, Roths. (591), *Ceratophyllus nilgiriensis*, Jord. & Roths. (238), *Stivalius* sp.

(387), *Leptopsylla segnis*, Schönh. (*musculi*, Dugès) (16), *Ctenocephalides* (*Ctenocephalus*) sp. (1) and *Pulex irritans*, L. (14), were collected from rodents and their nests. *M. rattus*, *B. malabarica* and *Gunomys kok* are considered to be the typical domestic, semi-domestic and field species of rodent essentially concerned in the epidemiology of plague in the Nilgiris. Short notes are given on the appearance and habits of the rodents examined, except the very common house rats and mice (*M. rattus* and *M. musculus*). All the 120 fleas collected from 5 individuals of *G. kok* and their nests at an altitude of 7,400 ft. were *Ceratophyllus nilgiriensis*, while of 230 collected from 60 individuals from gardens at Coonoor at 5,730 ft., 199 were *Stivalius* sp., 19 *C. nilgiriensis*, 11 *X. brasiliensis* and 1 *X. cheopis*. A rat-flea survey of Ootacamund in 1929 had shown that while *X. cheopis* comprised about 50 per cent. of the fleas on *M. rattus*, it comprised only about 8 per cent. of those on *G. kok*, over 83 per cent. of the fleas on the latter being *C. nilgiriensis*. *G. kok* is susceptible to plague, and its part in the epidemiology of the disease therefore depends on the efficiency as vectors of the fleas that parasitise it. *B. malabarica* at Coonoor was infested with *X. astia*, *X. cheopis*, *X. brasiliensis* and *C. nilgiriensis*, their specific indices declining in the order in which they are named. The *cheopis* index was 1·2. *Golunda ellioti*, the only species of its genus taken, with the exception of one unidentified individual, harboured very few fleas and these were *C. nilgiriensis* or *Stivalius*, whereas in the Cumbum Valley it harbours only *X. astia*. It is susceptible to plague, but probably plays only a small part in its transmission, as it is infested by so few fleas and seldom by *X. cheopis*. *Leggada booduga* is also susceptible, but harbours very few fleas. The *cheopis* index of *M. rattus* for Coonoor in 1939 was 1·73 and for Ootacamund in 1929, 1·75. *X. cheopis* was the predominant species in both instances. This may alone explain the endemicity of plague in the Nilgiris district. The next most abundant fleas on this rat were *C. nilgiriensis* in Ootacamund and *X. brasiliensis* in Coonoor.

All rodents obtained were autopsied, and those with signs that might indicate the presence of plague were studied by cultural methods, animal inoculation, smear examination, etc., and three carcasses of *M. rattus* proved positive. Infection was proved in the 120 live fleas collected from them. No definite signs of plague were noted in any of the other rodents or fleas examined, most of which had been collected from areas where there had been no recent infection. Transmission experiments were carried out with *Stivalius* sp. and *C. nilgiriensis*, and their efficiency as vectors is discussed. *Stivalius* transmitted plague to a white mouse 3 days after separation from an infected host. *C. nilgiriensis* harboured plague bacilli in the alimentary tract up to 7 days after having fed on an infected host, but the test mouse did not become infected. *L. segnis* is known to be a weak vector of plague that only reluctantly bites man. The three species of *Xenopsylla* are all good vectors. *P. irritans*, which is prevalent, has been supposed to be able to spread plague, but experimental proof of this is lacking. Fleas of the genus *Ctenocephalides* are not good vectors among rodents as they feed reluctantly on them.

The usual seasonal variations in the incidence of plague are not evident in the Nilgiris district. This is thought to be due to the presence of more than one vector species of flea, the different species transmitting best at different temperatures. No definite proof was obtained of the presence or absence of sylvatic plague.

HOLLAND (G. P.). **A Survey of the Rat Fleas of the southern British Columbia Coast with Relation to Plague Studies.**—*Proc. ent. Soc. B. C.* no. 37 pp. 1–5, 4 refs. Vernon, B.C., 1941.

A survey of the fleas on rats and mice in the cities of Vancouver and New Westminster, British Columbia, was made between 28th August and 27th November 1939 [*cf. R.A.E.*, B **25** 179]. The records for Vancouver are divided into those from garbage dumps and those from the waterfront, but as differences in infestations in the different areas of New Westminster were slight, only total results are given. *Mus* (*Rattus*) *norvegicus* represented 94·4 per cent. of the rodents taken. At the city dump at Vancouver, 725 rats of this species were taken, and they were harbouring 1,403 fleas, comprising 1,021 examples of *Xenopsylla cheopis*, Roths. [*cf.* **28** 144], 358 of *Ceratophyllus* (*Nosopsyllus*) *fasciatus*, Bosc, and 24 of the genus *Ctenocephalides*; at the waterfront areas, the corresponding figures were 316, 615, 2, 611 and 2. At another dump, 115 rats of this species were virtually free from fleas, only 7 individuals of *Ceratophyllus fasciatus* being found on them. At New Westminster, 66 were harbouring 52 fleas, 16 *X. cheopis* and 36 *C. fasciatus*. In addition, 7 individuals of *M.* (*R.*) *rattus alexandrinus*, 1 of *M.* (*R.*) *r. rattus* and 68 mice (*Mus musculus*) were taken in Vancouver and yielded, respectively, 7, 1 and 3 fleas, all of which were *C. fasciatus*. The sex ratios in the flea populations studied are shown in a table. It is pointed out that as most of the rats were trapped, the figures given here are conservative ones. Two groups of rats that were shot had *cheopis* indices of 2·17 and 3·42, respectively.

The rodents were carefully examined for lesions of the liver or spleen or enlarged lymph glands that might indicate the presence of plague, and almost all fleas were kept for inoculation tests. Plague has not yet been found in British Columbia, but the large and apparently increasing rat population and abundant fleas constitute an important potential reservoir, particularly in view of the high *cheopis* index in some areas.

GREGSON (J. D.). **The Discovery of an Ixovotoxin in *Dermacentor andersoni* Eggs (Acarina : Ixodidae).**—*Proc. ent. Soc. B. C.* no. 37 pp. 9–10, 2 refs. Vernon, B.C., 1941.

In the course of studies on developing eggs of *Dermacentor andersoni*, Stiles, carried out in British Columbia during 1939–40, chick embryos, ten days old, were killed overnight by inoculations of 0·15 cc. of the sterile filtrate of three-quarters of the egg mass from one tick ground in 3 cc. of saline. As this was suggestive of the ixovotoxin found in the eggs of certain ticks in Jugoslavia [*R.A.E.*, B **27** 149, etc.], an attempt was made with the few remaining eggs to confirm the presence of a toxin by injection into a guineapig. An emulsion prepared by grinding 0·540 gm. tick eggs (about one week before they were ready to hatch) with 5 cc. of 0·75 per cent. saline was filtered through a Seitz disk and collected under aseptic conditions, and 3 cc. of the filtrate was injected subcutaneously at 5 p.m. into the dorsal part of the neck of a guineapig weighing 650 gm. The following morning, the guineapig showed signs of weakness and loss of appetite and had a temperature of 105·0°F. Thereafter, the temperature fell steadily, and after a fortnight, the animal had completely recovered. The guineapig was

later shown not to be immune from Rocky mountain spotted fever. The reaction is, therefore, thought to indicate the presence of a potent toxin in the eggs of *D. andersoni*.

[Shcheglova (A. I.).] **Щеглова (А. И.). On the Rôle of the wild Vertebrates on the Forest Pastures as intermediary Hosts of Ticks** *Ixodes ricinus* **L.** [*In Russian.*]—*Probl. Ecol. Biocenol.* no. 5–6 pp. 83–101, 5 graphs, 15 refs. Leningrad, 1939. (With a Summary in English.) [Recd. 1941.]

A detailed account is given of investigations carried out in 1935 in the Province of Leningrad to determine the species of wild vertebrates that occur in forest pastures and harbour various stages of *Ixodes ricinus*, L. [*cf. R.A.E.*, B **24** 298], which transmits piroplasmosis of cattle and also attacks sheep and other domestic animals. The topography, soil, vegetation and fauna of the pastures examined are described, and tables are given showing the 55 species of vertebrates taken, the numbers examined, and, for the species found infested, the numbers that harboured ticks and the numbers of larvae, nymphs and adults on them. The species infested comprised 12 birds, 9 mammals and a lizard. The greatest numbers of ticks, chiefly larvae, occurred on mammals, which were most infested in the first half of the summer; the chief mammalian hosts included the shrew, *Sorex araneus*, the rodents, *Apodemus flavicollis* and *Evotomys glareolus*, and particularly the hedgehog, *Erinaceus europaeus*, which, however, harboured more nymphs than larvae. The birds were most infested at the end of June and beginning of July, chiefly by nymphs, and the principal hosts among them included thrushes (*Turdus* spp.) and *Anthus trivialis*. Adult ticks occasionally occurred on hedgehogs, and isolated individuals were taken on *Apodemus agrarius* and *Anthus trivialis*.

The author considers that the number of ticks in forest pastures depends, to some extent, on the presence of wild vertebrates, and that it is important to take this factor into consideration when planning measures for control.

Joyeux (C.) & Sautet (J.). **Présence de** *Rhipicephalus sanguineus* **(Latreille, 1806) chez le blaireau.**—*Bull. mens. Soc. linn. Lyon* **10** no. 5 p. 72. Lyons, 1941.

Several examples of *Rhipicephalus sanguineus*, Latr., were taken on a badger in the neighbourhood of Marseilles. This is the first record of the tick from this host.

Finlayson (M. H.), Grobler (J. M.) & Smithers (R.). **Studies in South African Rickettsiosis. 1. A Tick-borne Rickettsiosis isolated from** *Hyalomma aegyptium*.—*S. Afr. J. med. Sci.* **5** no. 3 pp. 41–45, 9 refs. Johannesburg, 1940.

About 1,000 ticks comprising 32 batches collected at intervals in various areas of the Cape Peninsula of South Africa were examined with a view to obtaining information on the vector of tick-bite fever. Each batch, including larvae, nymphs and adults of a certain species, was emulsified with 0·85 per cent. saline, and the supernatant fluid was

injected subcutaneously into a guineapig. If during 16 days there was no rise in the guineapig's temperature, the batch was considered not to be infective. One batch, composed of a species of *Hyalomma* [probably *H. impressum*, Koch, but here called *H. aegyptium* (*cf. R.A.E.*, B **24** 196; **28** 252)] obtained from a cow at Rugby, produced a high temperature in the guineapig with marked scrotal swelling apparent on the sixth day, and other reactions typical of tick-bite fever. Smears taken from the spleen and tunica vaginalis showed small numbers of rickettsia-like bodies. Two guineapigs were inoculated intraperitoneally with brain material from the infected one, which was killed on the ninth day after inoculation, and both showed almost identical reactions. The strain was then maintained through 39 passages, with intervals of about 10 days between each passage, after which time it died out.

No signs of infection were produced in rabbits nor was the presence of agglutinins for the Proteus X strains demonstrable in their serum. Australian Q fever (*Rickettsia burneti*) [**28** 226, 227], American Q fever [*R. diaporica*] [**28** 229, 230, etc.] and the heartwater disease of cattle [*R. ruminantium*] are the only known rickettsial infections in which no agglutinins are produced against any of the Proteus X strains, but it is only with difficulty that agglutinins are produced in rabbits by injection of tick-bite fever strains. The strain isolated from *Hyalomma*, like the Q fevers, produced enlargement of the spleen in guineapigs and an inapparent infection in white mice and rats. Tick-bite fever does not produce an apparent infection in white mice. Cross-immunity tests with guineapigs showed the relationship of the strain to South African louse-borne typhus and murine typhus to be the same as that borne by tick-bite fever to these infections. Guineapigs that had recovered from infection with the *Hyalomma* strain were not protected against louse-borne or murine typhus, but guinea-pigs inoculated with one of the typhuses were protected against the *Hyalomma* strain [*cf.* **28** 252]. The relationship existing between Australian Q fever and the typhus strains is similar. However, unlike the Q fevers, the *Hyalomma* strain did not pass Berkfeldt N filters and produced a scrotal reaction in guineapigs. It did not produce rickettsiae in the spleen of infected white mice, while Australian Q fever produced them in large numbers.

HADDOW (A. J.). **The Influence of Nutrition on Egg-production and Longevity in Unmated Female Body-lice** (*Pediculus humanus corporis*: **Anoplura**).—*Parasitology* **33** no. 1 pp. 40–46, 1 fig., 7 refs. London, 1941.

From experiments in which isolated unmated females of *Pediculus humanus humanus*, L. (*corporis*, DeG.) were kept constantly between the body and the clothes throughout their adult life and allowed to feed daily for periods of varying length, it is concluded that until the feeding period is reduced to less than 12 hours per day little decrease occurs in longevity or reproductive activity. Below this level a sharp fall occurs in both. In general, rates of oviposition were high. This suggests that when large stocks of lice are being reared, the rate of production may be increased by keeping them close to the skin even when they are not feeding. In the case of persons who find it injurious or impossible to permit continuous feeding, the feeding period may be reduced to 12 hours per day without seriously lowering the output of eggs, so long as the boxes are worn constantly under the clothes.

Buxton (P. A.). **On the Occurrence of the Crab-louse** (*Phthirus pubis*: **Anoplura**) **in the Hair of the Head.**—*Parasitology* **33** no. 1 pp. 117–118, 5 refs. London, 1941.

In the course of an examination of over 3,000 samples of hair from the scalp of persons from three localities in Asia and four in Africa [*cf. R.A.E.*, B **24** 97; **26** 116; **28** 234], examples of *Phthirus pubis*, L., were found in from 0·2 to 0·7 per cent. of the samples from all localities except one from which only 102 samples were examined. There was no evidence of correlation between infestation with *Phthirus* and with *Pediculus humanus capitis*, DeG. The number of individuals of *Phthirus* in each of the 18 infested samples ranged from 1 to 33, with an average of 6·2. It is emphasised that this louse has several ways of spreading through the human community.

Leeson (H. S.). **The Survival of unfed** *Pediculus humanus corporis*, **De Geer** (**Anoplura**) **at different Temperatures.**—*Bull. ent. Res.* **32** pt. 1 pp. 49–51, 3 refs. London, 1941.

The procedure used in an investigation of the maximum time that initially well-fed second-instar nymphs and adults of *Pediculus humanus humanus* L. (*corporis*, DeG.) can survive when starved at different temperatures is briefly described, and the detailed results are given in tables and the findings compared with those of earlier workers. The periods required for complete mortality of nymphs rose progressively from 2 days at 35°C. [95°F.] to 10 at 15°C. [59°F.], but at lower temperatures results were less consistent. The periods of survival of adults were not significantly different from those of nymphs.

Jackson (C. H. N.). **The Economy of a Tsetse Population.**—*Bull. ent. Res.* **32** pt. 1 pp. 53–55, 4 refs. London, 1941.

Data for the first eighteen months' work in the marking experiments on *Glossina morsitans*, Westw., carried out in Tanganyika Territory, between July 1938 and May 1940, the results of which are here summarised and discussed, have already been noticed from a more detailed paper [*R.A.E.*, B **29** 123], and the work done in 1940 does not alter the conclusions. By the modified method, it is estimated that the population averages about 1,000 males per sq. mile with perhaps twice as many females [*cf.* **22** 13]. Work by J. Ford suggests that the low emergence rate at the end of the dry season and through the early rains in the area from which fire was excluded [**29** 124] should be attributed to increased destruction of pupae by ants (*Pheidole*) in that area. By releasing unmarked flies and others marked with oil paints in an area where the species does not occur naturally, it was shown that unmarked flies live significantly longer than marked ones. The reason for this is not known, but it was shown to be neither the effect of handling nor of any direct lethal action of the paints, nor did the use of less conspicuous colours increase survival.

Malbrant (R.). **Gibier, tsé-tsés et trypanosomiases.**—*Bull. Serv. zootech. Épizoot. A. O. F.* **3** fasc. 3 pp. 187–202, 2 refs. Dakar, 1940.

The destruction of game as a method of controlling trypanosomiasis in Africa is discussed, and it is concluded that far from exterminating

tsetse flies, which would be maintained on birds, reptiles, rodents and other animals not classed as game, such a course would force the flies to rely much more on man and domestic animals for food. Strong, Bequaert & Cleveland [*R.A.E.*, B **20** 201] divide tsetse flies into three groups, typified by *Glossina palpalis*, R.-D., *G. tachinoides*, Westw., and *G. morsitans*, Westw., according to their relation with game, and a table is drawn up from data obtained by them showing the results of various workers who demonstrated that mammalian blood usually composed less than 50, about 70 and over 90 per cent. of the blood in flies of these three species, respectively. It is emphasised that the distribution of game and tsetses does not invariably correspond ; the correspondence in the case of the *morsitans* group may be due not solely to a preference of the flies for game but also to the fact that they are favoured by the same conditions as the latter. This is proved by the fact that when certain species of game begin their annual migration, the flies, even *G. morsitans*, only accompany them a short distance. Although the severe epizootics of rinderpest in South Africa that often exterminated herds of buffalo and antelope often coincided with the disappearance of *G. morsitans*, many non-susceptible animals survived and the tsetses could not have died of hunger. Evidence that some other factor intervened is provided by the fact that the tsetses disappeared at the same time from regions where the game had not been seriously affected.

It is also suggested that the extermination of game would result in the adaptation to man of certain trypanosomes that at present are pathogenic to domestic animals only. The author considers that there is no proof that big game can be a reservoir of *Trypanosoma gambiense* ; and that a study of the evolution of the foci of sleeping sickness caused by *T. rhodesiense* and the ease with which they can be stamped out in certain regions by the proper treatment of infected persons, without any change being made in the animal population, shows that game plays no part, or only an occasional one, in the conservation and propagation of this trypanosome. Various species of game can be reservoirs of trypanosomes pathogenic to domestic animals, and a table incorporating the results of many workers is given to show that the proportion of game animals harbouring trypanosomes in a region infested with tsetse flies is often considerable. It is thought, nevertheless, that the destruction of big game to remove one of the principal reservoirs of animal trypanosomiasis would not have the desired effect, as domestic stock also plays an important part and often harbours latent infection.

Case (A. A.) & Ackert (J. E.). **Intermediate Hosts of Chicken Tapeworms found in Kansas.**—*Trans. Kans. Acad. Sci.* **42** pp. 437–442, 22 refs. Manhattan, Kans., 1939. **New intermediate Hosts of Fowl Cestodes.**—*Op. cit.* **43** pp. 393–396, 7 refs. 1940.

Recent studies have shown that Carabids are doubtless the principal intermediate hosts of the commoner fowl Cestodes. These papers deal with the intermediate hosts of species found in Kansas. In the first, lists are given of the 10 species that occur in the United States, and of the intermediate hosts of the six that occur in Kansas and of one that may have been overlooked there on account of its small size. Five of these seven, all of which occur in Kansas, have insects as hosts.

Those of *Raillietina cesticillus* comprise 25 species of Carabids belonging to nine genera, of which the most important are *Cratacanthus* and *Amara*, besides two Lamellicorns, three Tenebrionids, a Trogositid and a Telephorid. The hosts of *Hymenolepis carioca* are a Carabid, two Lamellicorns, a Histerid and the Muscid, *Stomoxys calcitrans*, L. ; and those of *Choanotaenia infundibulum* are five Carabids, a Trogositid, three Lamellicorns, a Staphylinid, a Tenebrionid, *Musca domestica*, L., and two Acridids. *R. tetragona* and *R. echinobothrida* develop in ants [*cf. R.A.E.*, B **27** 58]. Three of the Coleopterous hosts of *C. infundibulum* are here recorded as such for the first time.

In the second paper, a list is given of five genera and eight species of Coleoptera (Carabids, Lamellicorns and a Tenebrionid) not previously reported as hosts of *R. cesticillus*, that developed cystercercoids to the infective stage in 1939. Only one Carabid not previously recorded as such was found to be a host for *C. infundibulum*. Nine out of ten Carabids collected from a poultry yard were infested with cysticercoids of *R. cesticillus*, and four of these had *C. infundibulum* also. The cysticercoids were infective for fowls. In group studies, large percentages of beetles were parsitised by gravid proglottids of *R. cesticillus* in the presence of their natural food. Six species of ants were observed to carry proglottids of *R. tetragona* to their nests, and although no cysticercoids have been recovered from the ants, it is possible that they act as intermediate hosts.

GJULLIN (C. M.), HEGARTY (C. P.) & BOLLEN (W. B.). **The Necessity of a Low Oxygen Concentration for the Hatching of *Aedes* Mosquito Eggs.**—*J. cell. comp. Physiol.* **17** no. 2 pp. 193–202, 12 refs. Philadelphia, Pa., 1941.

It is shown that a reduction of the dissolved oxygen from about 7 to below 3 parts per million in the medium in which the eggs of *Aëdes vexans*, Mg., and *A. lateralis*, Mg., are immersed will cause them to hatch. This condition may be produced in the laboratory by organic or inorganic reducing agents or by the mechanical removal of oxygen. Determinations of the oxidation-reduction potential of various solutions in which the eggs were found to hatch showed that hatching is not affected by an initial potential within the range E_h110 to 786. It therefore appears that the effect on hatching of the presence of reducing agents is due entirely to their ability to remove oxygen from the water. As in limited tests with *A. cinereus*, Mg., and *A. varipalpus*, Coq., as well as in previous tests with *A. dorsalis*, Mg., the presence of bacteria seemed necessary to stimulate hatching, a reduction of the dissolved oxygen is probably an important stimulus to the hatching of eggs of these species also. In nature in the United States, eggs of *A. vexans*, *A. lateralis*, *A. dorsalis* and *A. cinereus* are laid on moist soil, where they may be covered by flood waters, and the eggs of *A. varipalpus* in hollow tree trunks, which become flooded with rain water. The stimulus causing the eggs of these species to hatch in nature may be the reduction of dissolved oxygen by organic material, bacteria and other organisms in the water. When temporary floods cause hatching in nature, the newly hatched larvae are normally found only in shallow water. It is only in such water that a reduction of dissolved oxygen can occur, as deep or running water would not normally contain enough bacteria or organic matter. A regulatory mechanism of this kind would contribute to the survival of the species by insuring the hatching

of the eggs in an environment containing abundant food for the larvae. Unpublished data obtained by W. V. King and R. C. Bushland showed that a large percentage of fresh eggs of *A. aegypti*, L., will hatch in water containing a normal amount of dissolved oxygen, but only a small number of eggs 20 days old or more will hatch unless the dissolved oxygen is slightly lowered [*cf. R.A.E.*, B **22** 247]. The eggs of this species are normally laid on or just above the surface of water, and the bacteria and organic materials that provide the stimulus for hatching the dry eggs also ensure the presence of organic food for the larvae. The eggs of *Theobaldia incidens*, Thoms., *Culex pipiens*, L., and *Anopheles punctipennis*, Say, which have previously been found to hatch readily in tap water, are laid on the surface of the water in situations having an abundance of larval food and have, therefore, no need for an environmental mechanism to regulate hatching. Since they do not sink below the surface of the water, they could not be appreciably affected by a reduction of the dissolved oxygen.

Ross (G. R.) & Aylen (D.). **Erosion and Malaria. Measures which control both Evils.**—*Rhod. agric. J.* **38** no. 4 pp. 173–191, 9 pls. Salisbury, S. Rhod., 1941.

The breeding places of *Anopheles gambiae*, Giles, and *A. funestus*, Giles, the vectors of malaria in Southern Rhodesia, are briefly described, and it is pointed out that, directly or indirectly, a very large proportion of them are provided by erosion. In such cases, the best methods of controlling malaria are those designed to prevent the erosion. This paper deals principally with the types of erosion and ponding likely to occur within a radius of half a mile of dwellings, where the elimination of breeding places is most important. A comprehensive plan is given, based on the requirements of a hypothetical farm presenting all the problems likely to be met with. It comprises the making of storm drains above the area, the replacement of any eroding drain by a grassed channel, the provision of drains round the house and in garden, stock-yards and compound, road drainage, planting of bare areas and drains, making up the ground round water troughs and at gates, and protection work in minor gullies. The low cost of such measures as compared with that of temporary ones is emphasised. The nature of minor gully erosion, the design and lay-out of drains, the planting of couch grass on bare areas, the laying out of roads and their drainage, the treatment of small streams, the control of gully erosion and the treatment of banks of large gullies are dealt with in fair detail, and a list is given of trees that may be used to dry up moist soil.

Kariadi (—). *A. hyrcanus "X"* **en filariasis malayi te Martapoera.** [*Anopheles hyrcanus X* and Filariasis due to *Filaria malayi* at Martapoera.]—*Geneesk. Tijdschr. Ned.-Ind.* **81** pt. 3 pp. 107–118, 3 graphs, 13 refs. Batavia, 1941. (With a Summary in English.)

The variety of *Anopheles hyrcanus*, Pall., that occurs at Martapoera, in south-eastern Borneo, was considered to be *sinensis*, Wied. [*cf. R.A.E.*, B **26** 230], but all of 90 examples submitted to Venhuis were identified by him as *A. hyrcanus X* [*cf.* **28** 127]. Recent observations have shown that it is more numerous at Martapoera than *A. barbirostris*, Wulp, which was previously thought to be the predominant Anopheline [*cf.* **26** 230]. It is especially common in the rainy season and in the

swamp area that favours the breeding of mosquitos, including *Mansonia uniformis*, Theo. It is considered responsible for the few cases of malaria that occur at Martapoera, while 18 of 243 examples taken in gardens in daytime were infected with *Filaria malayi*, one containing a fully developed larva in the head. Dissections showed that of 167 females fed on a carrier of *F. malayi*, 131 became infected, giving a "crude" artificial infection index [**26** 162] of 78. Another test, of which the results are recorded in a figure, showed the progressive growth of the parasites in the mosquitos ; some completed their development, but degenerated forms were also present from the second day. In a similar test with *M. uniformis*, growth was more regular, the "crude" infection index was 81, and the percentage of larvae in the head was higher. It is therefore concluded that *A. hyrcanus X* is a less effective vector than *M. uniformis*, and much less effective than is *A. barbirostris* at Kalawara [*cf.* **25**·232]. Filariasis is prevalent at Martapoera, and a filaria index of 45 per cent. is not uncommon there.

Mooij (W.). **Over de crithidiën van** *Triatoma rubrofasciata* **De Geer (10de Mededeeling).**—*Geneesk. Tijdschr. Ned.-Ind.* **81** pt. 8 pp. 394–397. Batavia, 1941. (With a Summary in English.)

In further laboratory investigations in Java on the ways in which *Triatoma rubrofasciata*, DeG., is able to infect mice with *Trypanosoma conorhini* [*cf. R.A.E.*, B **25** 164], infected bugs in all the active stages were allowed to feed on healthy mice. The results were uniformly negative, and it is concluded that there is no evidence that the bugs infect rats by feeding on them.

Botelho de Macedo (M.). **O problema do alojamento dos ranchos migratórios nas zonas sezonáticas.** [The Problem of Housing itinerant Labour in malarial Districts.]—*Sér. Estud. Inf. téc.* no. 13, 140 pp., 14 pls. (8 fldg.), 80 figs., refs. [Lisbon] Minist. Econ., Dir. ger. Serv. agríc., 1940.

It is estimated that 50,000 cases of malaria occur annually in Portugal, from 200 to 400 proving fatal. The disease is limited to certain regions, the most severely affected being those in which slow-flowing rivers deposit much alluvium and rice is intensely cultivated. *Anopheles maculipennis* var. *atroparvus*, van Thiel, is the vector [*cf. R.A.E.*, B **28** 117]. There are in Portugal large numbers of agricultural workers who move from place to place as labour is required, and this paper deals at some length with the problem of providing them with suitable housing protected against mosquitos. The subjects discussed include the adaptation of existing buildings, the erection of new ones, building materials, repairs, the kinds of quarters it is desirable to provide, and anti-mosquito screening.

Cova-Garcia (P.). **Notas sobre los Anofelinos de Venezuela y su identificación.**—*Publ. Div. Malariol.* no. 2, 34 pp., 10 pls., 3 pp. refs. Caracas, 1939. [Recd. 1941.]

Records of the finding of species of *Anopheles* in Venezuela are reviewed, and a list is given of the 21 species that have been shown to occur there. In addition to those already noticed [*R.A.E.*, B **27** 43 ; **28** 45], they comprise *A. bellator*, D. & K., *A. cruzi*, D. & K., *A.*

peryassui, D. & K., *A. kompi*, Edw., *A. pessôai*, Ayroza Galvão & Lane, and *A. boliviensis*, Theo. The States in which each species occurs are shown in a table. Characters are given distinguishing the tribes of the CULICINAE, the Anopheline genera and the subgenera of *Anopheles*, those distinguishing the larvae and adults of the Venezuelan species of *Anopheles* are shown in keys and tables, and their anatomy, methods of collecting and preserving them and the technique of dissecting the females for malaria infection and of obtaining experimental infection in them are discussed.

COVA-GARCIA (P.). **La legislación antimalarica venezolana y proyecto de reglamentación.** [Anti-malarial Legislation in Venezuela and a Scheme of Regulations.]—*Publ. Div. Malariol.* no. 6, 34 pp., 7 pp. refs. Caracas, 1940.

The development of health legislation in Venezuela is briefly reviewed, and it is stated that the need for drainage of marshes and clearing of the banks of streams and lakes was recognised in it in 1838. In 1909, measures against yellow fever specified the screening of cases and work against the larvae and adults of the mosquito vector [*Aëdes aegypti*, L.]. In 1912, instructions were given for the control of Anophelines that transmit malaria. Existing legislation empowers local authorities to take measures for malaria control, including those directed against mosquitos, but since the measures are not definitely specified and there have been considerable local variations, the author outlines a series of regulations that he considers would provide a basis for uniform and practical work.

VARGAS (L.). **Detalles morfológicos de los *Anopheles* americanos del grupo *maculipennis* y especies próximas.** [Morphological Details of the American *Anopheles* of the *maculipennis* Group and of allied Species.]—*Ciencia* **2** no. 1 pp. 23–25, 4 figs., 4 refs. Mexico, D.F., 1941.

The American Anophelines of the group of *Anopheles maculipennis*, Mg., comprise *aztecus*, Hffm., *freeborni*, Aitken, and *occidentalis*, D. & K., which are commonly considered varieties of this species. Closely allied to them are *A. atropus*, D. & K., *A. barberi*, Coq., *A. quadrimaculatus*, Say, and *A. walkeri*, Theo. Keys are given to the females of these seven Anophelines and (based on the genitalia) to the males of six of them (omitting *A. occidentalis*). Characters distinguishing the larvae of these six from each other and from those of the three varieties of *A. crucians*, Wied. [*R.A.E.*, B **28** 45, 46] are also given, and the larva of *freeborni* is described.

DAGGY (R. H.), MUEGGE (O. J.) & RILEY (W. A.). **A preliminary Survey of the Anopheline Mosquito Fauna of southeastern Minnesota and adjacent Wisconsin Areas.**—*Publ. Hlth Rep.* **56** no. 17 pp. 883–895, 1 pl., 1 map, 8 refs. Washington, D.C., 1941.

The number of locally acquired cases of malaria that occur from time to time in Minnesota and Wisconsin appears to be increasing, and as it was thought that the increase might be due to the dams constructed across the Mississippi for the improvement of navigation, an intensive survey of the Anopheline fauna along both banks from Wabasha,

Minn., to La Crosse, Wis., was carried out between 26th August and 27th September 1939. The weather was favourable, the mean monthly temperature for September being 69·1°F., 6·6° above the average. Anophelines were much more abundant than was previously supposed, and the catches included all the species already recorded from the region, *viz. Anopheles maculipennis*, Mg., *A. punctipennis*, Say, *A. quadrimaculatus*, Say, and *A. walkeri*, Theo., though *A. maculipennis* was so rare that it is dismissed as of no significance. Anophelines comprised 95·7 per cent. of the 12,321 mosquitos taken in buildings in scattered areas. *A. quadrimaculatus* comprised 91·7 per cent. of the Anophelines taken in buildings in the river valley, but in the surrounding hills and valleys, it comprised only 14·1 per cent., the bulk of the catch consisting of *A. punctipennis*. *A. walkeri* and *A. maculipennis* were each represented by a single individual. Although *A. quadrimaculatus* is the most important vector of malaria in the southern States, the authors are of the opinion that it may not be the chief one in Minnesota, in spite of its abundance, as most of the dwellings are well screened and *A. walkeri*, also an efficient vector [*cf. R.A.E.*, B **28** 122, etc.], readily attacks man in the open in bright sunlight. Of the 134 Anophelines taken while attacking man in the open, *A. quadrimaculatus*, *A. punctipennis* and *A. walkeri* comprised 11·9, 3 and 85·1 per cent., respectively. Three light-traps were operated during the survey, and rather more than 20 per cent. of the mosquitos caught were Anophelines. In a residential area, *A. quadrimaculatus* comprised 74·4 per cent. of the latter, but in two swamp areas, *A. walkeri* was the dominant species and comprised 67·7 and 84·7 per cent.

Anopheline larvae were numerous throughout the valley in clean, quiet shallow waters with abundant vegetation such as sloughs and backwaters. Of 948 reared, *A. quadrimaculatus*, *A. punctipennis* and *A. walkeri* comprised 57·4, 38·6 and 3·9 per cent., respectively, and *A. maculipennis* was represented by a single individual. It is suggested that eggs deposited by *A. walkeri* may be scattered more sparsely than those of the other species and that this explains the small proportion found as, owing to lack of time, little attention was given to breeding places yielding only a few larvae. *A. walkeri* appeared to favour submerged grassy areas for oviposition, and these are extensive in the region, so that the total number of mosquitos produced in them might be considerable though concentration was low. There is evidence that the dams have increased the number of breeding places for *A. quadrimaculatus* and apparently for *A. walkeri* also. In the hills, *A. punctipennis* was by far the dominant species and was the only one breeding in the spring-fed streams and pools. *A. quadrimaculatus* was found in static water only. They comprised 98·8 and 1·2 per cent. of the total reared, respectively.

HINMAN (E. H.) & others. **Additional cooperative Studies of the Relation between Mosquito Control and Wildlife Conservation.**—*Science* **94** no. 2428 pp. 44–45, 2 refs. New York, N.Y., 1941.

This is a report on work done in the summer of 1940 on mosquito control and wildlife preservation in the reservoirs of the Tennessee Valley Authority [*cf. R.A.E.*, B **29** 42]. The results of a quantitative investigation of the relative importance of 20 species of aquatic plants in the production of *Anopheles quadrimaculatus*, Say, indicated that the structure and growth characteristics of the plants and the way

they interact with external factors are more significant in the breeding of mosquitos than are differences in species. At high water levels, emergent vegetation was important in Anopheline production, while at low water levels, submerged species became important. Floating-leaved species were important at both high and low water levels. In general, there was a positive correlation of the density of larvae with the abundance of flotage and frequently with the amount of vegetative cover. Encouraging results were obtained in the control of various species of plants by powdered sodium arsenite applied from an aeroplane four times at monthly intervals at the rate of about 8 lb. per acre. Coppice was particularly susceptible to the arsenite. It is concluded that such applications might reduce the vegetative cover sufficiently to make the application of larvicides more effective and even reduce the need for them. A study of the feeding habits of *Gambusia* showed that this fish materially reduced the production of mosquitos in the Tennessee Valley, though this reduction was insufficient to eliminate the need for other measures of control.

Papers noticed by Title only.

Wigglesworth (V. B.). **The Sensory Physiology of the Human Louse** *Pediculus humanus* [*humanus*, L.] *corporis* **De Geer (Anoplura).**—*Parasitology* **33** no. 1 pp. 67–109, 35 figs., 41 refs. London, 1941.

Spencer (G. J.). **Ectoparasites of Birds and Mammals in British Columbia. VI. A preliminary List of Parasitic Mites.**—*Proc. ent. Soc. B. C.* no. 37 pp. 14–18, 8 refs. Vernon, B. C., 1941.

Curtis (L. C.). **A preliminary List of the Species of** *Culicoides* **in Western Canada (Diptera : Ceratopogonidae).**—*Proc. ent. Soc. B. C.* no. 37 pp. 18–19. Vernon, B.C., 1941.

da Costa Lima (A.). **Nota sobre as especies de "** *Tunga* **" (Siphonaptera : Tungidae).** [A Note on the Species of *Tunga* (with a key).]—*—Acta med.* **5** no. 5 p. 300 repr. 4 pp. Rio de Janeiro, 1940.

Kohls (G. M.). **Siphonaptera : a Study of the Species infesting wild Hares and Rabbits of North America north of Mexico.**—*Bull. nat. Inst. Hlth* no. 175, iii + 34 pp., 3 pls., 8 maps. Washington, D.C., Supdt. Documents, 1940. Price 20 *cts.*

Cooley (R. A.) & Kohls (G. M.). **Further new Species of** *Ornithodoros* **from Bats (Acarina : Argasidae).** [*O. concanensis* from a bat cave and a bat-inhabited mine tunnel, and *O. kelleyi* from *Pipistrellus* sp., both in the United States.]—*Publ. Hlth Rep.* **56** no. 17 pp. 910–914, 1 pl., 8 figs. Washington, D.C., 1941.

Irwin (W. H.). **A preliminary List of the Culicidae of Michigan. Part I. Culicinae (Diptera).**—*Ent. News* **52** no. 4 pp. 101–105, 12 refs. Philadelphia, Pa., 1941.

EJERCITO (A.) & CELIS (E. B.). **Another Design of Automatic Siphon Sluice in Malaria Control. (Design II.)**—*Riv. Malariol.* **20** (1) no. 1 pp. 51–65, 6 pls. (2 fldg), 10 figs., 6 refs. Rome, 1941. (With a Summary in Italian.)

Details are given of the construction of an automatic siphon that was installed in a large stream in the Philippines and released volumes of water more than adequate for control of Anopheline larvae by flushing. A dam 186 cm. high with a span of 873 cm. from bank to bank was built across the stream. The siphon was placed astride the dam, the vertical inlet and outlet tubes being cement pipes 100 cm. in diameter, hermetically connected with each other by a conduit curving over the dam and forming the bend of the siphon. Such a large siphon will not operate as simply as the small one already noticed [*R.A.E.*, B **29** 129], because a large amount of air is compressed in the bend. To suck out this air, a small siphon, formed by an iron pipe 5 cm. in diameter, was placed beside the large one. The lower level of the bend of this small siphon was 4·54 cm. lower than the top of the dam. The top of the bend of the small siphon was connected by a pipe 5 cm. in diameter with the top of the bend of the large siphon. When the water above the dam rises, it starts the small siphon and compresses the air in the large one. This air is driven into the connecting pipe and becomes subject to suction by the water flowing through the small siphon [*cf.* **28** 166].

RUSSELL (P. F.) & MOHAN (B. N.). **An Insectary Colony of *A. stephensi mysorensis*.**—*Indian med. Gaz.* **76** no. 4 pp. 219–220, 3 refs. Calcutta, 1941.

Following two unsuccessful attempts to colonise *Anopheles stephensi* var. *mysorensis*, Sweet & Rao, in the insectary [*cf. R.A.E.*, B **28** 164], a third batch was obtained from Mysore and the variety successfully colonised through nine generations. The distinctive egg measurements [*cf.* **26** 50] were maintained in all the generations and in about 60 generations of the type form of *A. stephensi*, List. At first the sexes of *A. s. mysorensis* were reluctant to pair, but after males and females had been kept singly in vials for several days and the former fed on 10 per cent. glucose water and the latter on rabbit blood, pairing occurred without much delay when numbers of both sexes were put together in a colony cage. The reluctance of the females to oviposit was overcome by a forcing technique ; a gravid female was placed in a test-tube, the side of which was knocked gently a few times, and it was then flung into water in a dish by vigorously swinging the tube. If its legs became caught in the water, it usually began to oviposit at once ; if not, it flew upwards and the measure was repeated. When oviposition was completed, the female was lifted out on a filter paper and flew to the side of the cage when the paper became dry. There was considerably less reluctance in subsequent generations, and it was not necessary to repeat the technique.

ROY (D. N.), SIDDONS (L. B.) & MUKHERJEE (S. P.). **The Bionomics of *Dirhinus pachycerus* Masi (Hymenoptera : Chalcidoidea), a Pupal Parasite of Muscoid Flies.**—*Indian J. Ent.* **2** pt. 2 pp. 229–240, 9 figs., 24 refs. New Delhi, 1940.

Five adults of *Dirhinus pachycerus*, Masi, emerged from pupae of *Sarcophaga tuberosa*, Pand., in a laboratory in Calcutta [*cf. R.A.E.*,

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B **28** 104], and a large stock was reared from them in pupae of *S. rufi-cornis*, Wied., and *Chrysomyia megacephala*, F. The adults were sexually mature on emergence and paired readily in a wide-mouthed test-tube. Males were produced by parthenogenetic reproduction. The presence of food in the alimentary canal of the adults indicated that they feed, but it was not ascertained whether they take solid or liquid food. It is presumed that the size of the host pupa in relation to that of the immature stages of the parasite is the dominating factor in host selection. Various species of *Musca* and *Sarcophaga* were attacked but *Stomoxys calcitrans*, L., and *Drosophila melanogaster*, Mg., were always ignored. Oviposition took 10–30 minutes and only one egg was inserted at each attack. It was deposited on the early or mid-stage pupa in the puparium. One female parasitised 92 out of 100 available puparia in the course of a fortnight. After the egg is laid, the female turns to the puncture and applies its mouth to it, possibly to feed or possibly to seal the puncture with saliva, as when connection is established between the interior of the puparium and the air, both pupa and parasite die. As many as 6 eggs and 4 larvae were observed on a single pupa, but when infestation was multiple, all the parasites died or only one survived. There was no evidence that the larva was predacious on supernumerary eggs and larvae The egg and larva are described, and the function of the digestive and excretory system of the larva is discussed. The egg and prepupal stages both lasted about 2 days in Calcutta, and the larval and pupal stages lasted 7–10 and 12 days respectively, in summer and 18–20 and 25–30 in winter. There appears to be some possibility of using *D. pachycerus* in the control of the Muscoid flies readily parasitised by it. It can locate and parasitise hosts that are covered by shallow, loose sand or earth, but fails to attack those placed in loosely packed garbage or under a deep layer of sand.

RUATA (G.). **La lotta contro le mosche in Italia.** [Measures against Flies in Italy.]—*Ann. Igiene* **51** no. 2 pp. 111–113, 1 ref. Rome, 1941.

Great progress has been made in Italy in work against flies [*Musca domestica*, L.], and the use over a large area of a sweetened arsenical bait-spray [*cf. R.A.E.*, B **25** 206] has continued to give excellent results. Invert sugar has been substituted for molasses, and the stock solution now used for the spray contains 5 per cent. sodium arsenite (equivalent to 2·25 per cent. arsenic) and 30 per cent. invert sugar. The improved spray is more attractive to flies ; it is hygroscopic, so that the poison is ingested even when the drops appear to have dried up ; it is effective at greater dilutions ; and it does not stain.

HOFFMAN (W. A.). **The Effect of Chloroform on some Insect Bites.**—*Science* **94** no. 2429 p. 66. New York, N.Y., 1941.

The author tested the effect of applying chloroform to bites caused in Porto Rico by a species of *Trombicula*, mosquitos, a Simuliid, and *Culicoides furens*, Poey, the last being very common and annoying along the coastal plain of the island. There was a rapid cessation of pruritus, especially in cases of prompt application.

Studies in the Epidemiology of Q Fever.

Derrick (E. H.), Smith (D. J. W.) & Brown (H. E.). **6. The Susceptibility of various Animals.**—*Aust. J. exp. Biol. med. Sci.* **18** pt. 4 pp. 409–413, 1 fig., 4 refs. Adelaide, 1940.

Smith (D. J. W.). **7. The Biology of *Haemaphysalis humerosa* Warburton and Nuttall (Acarina, Ixodidae) in Queensland.**—*Op. cit.* **19** pt. 1 pp. 73–75, 1 fig., 5 refs. 1941.

The second of these papers consists of an account of the bionomics of *Haemaphysalis humerosa*, Warb. & Nutt., in Queensland from observations made during studies on Q fever, of which it is a vector [*R.A.E.*, B **28** 227–9; **29** 53]. A list is given of the hosts from which it has been collected and the larva is described. It is a three-host tick, dropping to the ground after engorgement in each stage.

Larvae placed on guineapigs 10 or more days after hatching usually became attached within 12 hours, and most of them were fully engorged 36–48 hours afterwards. During cool weather, however, they took longer to attach themselves. Upon bandicoots (*Isoodon torosus*) taken in the bush, larvae and nymphs were most frequently found attached to the feet, hindquarters and tail. The interval between leaving the host and moulting to the nymphal stage varied from 14 days at a mean monthly temperature of 70·2°F. to 33 days at one of 58·6°F. Nymphs placed on guineapigs 4–42 days after ecdysis usually attached themselves within 12–24 hours, falling from the host after a further 48–72 hours. The minimum durations of the nymphal stage were 14 and 39 days at 70·2°F. and 58·6°F., respectively. Adults were placed on guineapigs at intervals of 5–48 days after ecdysis. Males fed over a long period; some were removed when still feeding 4–5 weeks after being placed on the host. They frequently changed their site of attachment. Bandicoots caught in the bush always carried many more male than female ticks. The females were most commonly found in the region of the neck and shoulders. When fed on guineapigs, they usually engorged and dropped from the host in 8–14 days, though some engorged over a period of 26 days. Pairing occurred only on the host, usually 2–4 days after feeding had begun. In the absence of males, females remained attached to the host, but did not complete engorgement. In 20 ticks, the preoviposition, oviposition and postoviposition periods lasted 5–15, 10–20 and 2–26 days, with means of 5·7, 13·7 and 14·5, respectively, and the numbers of eggs laid were 200–1,000 with a mean of 485 by ticks fed on bandicoot and 50–260 with a mean of 138 by those fed on guineapig. The eggs began to hatch after 21 days at 64·5°F. or after 65 days when the mean temperatures for the two months were 60·2 and 58·6°F. Larvae, nymphs and adults were observed to live up to 72, 115 and 73 days, respectively. A table is given showing the durations of the various stages in estimated minimum and maximum life-cycles of 88 and 447 days.

In an examination of nearly 250 bandicoots during the three years from July 1937, adult ticks of both sexes were found during each month throughout the year, but there was a well marked seasonal variation in their numbers; larvae and nymphs were not found during the hot months (December–February), but were present throughout the rest of the year, and like the adults, increased markedly during early spring and autumn.

TORREALBA (J. F.). **Resumen de la práctica del xenodiagnóstico para la enfermedad de Chagas en Zaraza (Guárico, Venezuela).** [A Review of xenodiagnostic Work with Chagas' Disease in Zaraza, Venezuela.]—*Rev. Med. Vet. Parasit.* **2** no. 1–2 pp. 25–43, 4 pls., 38 refs. Caracas, 1940.

Having observed that rural dwellings in the district of Zaraza, in the State of Guárico, Venezuela, were infested with Triatomids infected with *Trypanosoma* (*Schizotrypanum*) *cruzi*, the author has, since 1933, made 66 examinations for Chagas' disease by the method of xenodiagnosis [*R.A.E.*, B **3** 56], obtaining 22 positive results. The bugs used were *Rhodnius prolixus*, Stål, and in a few cases, *Triatoma* (*Eutriatoma*) *maculata*, Erichs. Records of the cases are given.

VOGELSANG (E. G.) & DE ARMAS (J. C.). **La mosquilla del ganado, *Lyperosia irritans* (L. 1761) en Venezuela.** [The Hornfly, *L. irritans*, in Venezuela.]—*Rev. Med. Vet. Parasit.* **2** no. 1–2 pp. 95–98, 2 pls. Caracas, 1940.

Since 1937, *Lyperosia irritans*, L., has increased considerably in some cattle districts in the plains of Venezuela ; it is likely to develop into a serious pest as local conditions are favourable for it. Methods of control are very briefly reviewed, but none appears practicable under the conditions prevailing in Venezuela.

DA COSTA LIMA (A.). **Um novo "*Flebotomus*" da Amazonia e considerações relativas ás especies afins (Diptera : Psychodidae).** [A new *Phlebotomus* from the Amazon Region with Considerations on the allied Species.]—*Acta med.* **7** no. 1 pp. 5–19, 2 pls., 2 graphs, 14 refs. Rio de Janeiro, 1941. (With a Summary in English.)

The author gives a description of *Phlebotomus* (*Flebotomus*) *paraensis*, sp. n., from a single male taken in Pará, Brazil, in 1939 and discusses the identity of material from the collection of A. Lutz that has been considered to represent the species described by Lutz & Neiva as *P.* (*F.*) *squamiventris* [*R.A.E.*, B **1** 66]. He restricts the cotypes of the species to the material from Pará, doubtfully refers to it some specimens from Matto Grosso but excludes others, among which is the only existing male, and considers that a female taken in the Rio Negro region represents an undescribed species, for which he proposes the name *P.* (*F.*) *chagasi*. He gives a key to the species of *Phlebotomus* (including *P. chagasi*) in which the fifth palpal segment is shorter than the third.

VARGAS (L.). **New Variety of *Anopheles pseudopunctipennis* (Diptera, Culicidae).**—*Bull. Brooklyn ent. Soc.* **36** no. 2 pp. 73–74, 3 refs. Brooklyn, N.Y., April 1941. *Anopheles pseudopunctipennis willardi*, **n. var. (Dipt. Culicidae).** [*In Spanish.*]—*Rev. Soc. mex. Hist. nat.* **2** no. 1 pp. 47–49, 7 refs. Mexico, D.F., June 1941.

In the first paper, it is stated that the extensive distribution of *Anopheles pseudopunctipennis*, Theo., which occurs sporadically from the western United States to northern Argentina, and the fact that it is considered a dangerous vector of malaria in some regions but not in others [*cf. R.A.E.*, B **27** 122 ; **28** 29] led to the theory that it might include varieties differing in ability to transmit the disease.

From a study of the morphology of the eggs, the author distinguishes four varieties. In addition to the typical one, these are *boydi*, Vargas [**28** 46], *franciscanus*, McCracken, and *willardi*, var. n. Characters distinguishing the eggs of the four varieties and the larva and adults of both sexes of var. *willardi* are briefly described. It was found to occur over an area of about 60 sq. miles in the State of Chihuahua, Mexico, and was the only *Anopheles* taken in July and August 1940. The adults of both sexes enter houses and stables, and the larvae are found in sunlit pools and streams.

The second paper contains substantially the same information, but the notes on the distribution of *A. pseudopunctipennis* and the larval characters of the new variety are somewhat more detailed, and the morphological characters of the eggs of the four varieties are shown in a table.

VARGAS (L.). **Nota sobre los huevecillos de *Anopheles* mexicanos.** [Note on the Eggs of Mexican *Anopheles*.]—*Gac. med. Méx.* 1941 pp. 107–123, 12 figs., 17 refs. [Mexico, D.F.] 1941. (With a Summary in English.)

Reference is made to the importance of egg characters in distinguishing the varieties of *Anopheles maculipennis*, Mg., that transmit malaria in Europe, and the results are given of a morphological study of the eggs of some species of *Anopheles* that occur in Mexico. The technique by which oviposition was secured in the laboratory is described, and characters distinguishing the eggs of the Mexican species are shown in a key, based on original observations and the literature. Eggs laid in Tampico in November by ten females of *A. crucians* var. *bradleyi*, King, were morphologically identical with the summer-type eggs of *A. walkeri*, Theo., described by Hurlbut [*R.A.E.*, B **27** 40, 121]. The key also includes both types of egg of *A. punctipennis*, Say, though the author was unable to obtain the "unusual" winter type described by Lawlor [**28** 152]. Tables are given showing the measurements of eggs of *A. quadrimaculatus*, Say, *A. crucians* var. *bradleyi* and *A. vestitipennis*, D. & K., obtained from Tampico and characters distinguishing the four varieties of *A. pseudopunctipennis*, Theo., recognised by the author [*cf.* preceding abstract]. The evolution of these forms of *A. pseudopunctipennis* is discussed in relation to geological data, and evolutionary trends in neotropical Anophelines are shown in a table.

ROZEBOOM (L. E.), FOX (L. A.) & LAIRD (R. L.). *Anopheles* (*Kerteszia*) *bellator* **D. & K., found naturally infected with Plasmodium.**—*Science* **94** no. 2431 p. 114. New York, N.Y., 1941.

Anopheles bellator, D. & K., is the most abundant Anopheline in the cacao-growing districts of Trinidad, where it is suspected of being the vector of malaria. It breeds in the epiphytic bromeliads that grow on the immortelle shade trees. It is active during twilight, attacking man both in houses and out of doors, but as soon as it has fed it returns to the forests. This makes it difficult to catch engorged females for determining the natural malarial infection rates among them. Almost all the individuals caught by the authors appeared to be young females taking their first blood meals, but the 398th individual dissected, collected while attacking man, was infected with a single large oöcyst from which large numbers of motile sporozoites were obtained.

COVELL (G.). **Malaria Control by anti-mosquito Measures.**—2nd edn. (revd.), Demy 8vo, xiii+224 pp., 2 pls., 13 figs., 95 pp. refs. Calcutta, etc., Thacker, Spink & Co., Ltd., 1941. Price 12*s*.

This second edition of a work already noticed [*R.A.E.*, B **19** 225] contains, in addition to the original material, a fourth part (pp. 94–120) in which the author discusses the advances that have been made in the last ten years in the control of Anophelines that transmit malaria. He considers that the most important of these advances is the use of sprays of pyrethrum extract in oil against the adults in houses [*cf.* **24** 153; **25** 137; **26** 180; **29** 153], which is the only known method that can exert an immediate influence on the course of a malaria epidemic. Its application under Indian conditions is briefly discussed. The bibliography has been expanded, and a supplement to it covers 578 works published in 1931–40.

SULLIVAN (W. N.), MCGOVRAN (E. R.) & GOODHUE (L. D.). **Fumigating Action of a Mixture of Orthodichlorobenzene and Naphthalene applied by a new Method.**—*J. econ. Ent.* **34** no. 1 pp. 79–80, 7 refs. Menasha, Wis., 1941.

The following is based largely on the authors' summary. A new method of applying a mixture of naphthalene and orthodichlorobenzene consists in rapidly volatilising a solution of naphthalene in orthodichlorobenzene by spraying it on to a surface heated to about 375°C. [707°F.]. House-flies (*Musca domestica*, L.) and nymphs and adults of the cockroach, *Periplaneta americana*, L., were exposed for 24 hours in a 216-cubic foot chamber into which 80 cc. of a solution of 30 gm. naphthalene per 100 cc. was introduced. The process of spraying it took about 8 minutes, and very little crystallisation of the naphthalene followed. After exposure, the insects were kept in conditions in which mortality of controls was negligible. All the flies were dead after 1 day, and 94·4, 99·4 and 99·8 per cent. of the adult cockroaches and 53·6, 92·3 and 98·1 per cent. of the nymphs were dead after 1, 3 and 10 days, respectively. The use of this method offers promise for the control of certain household and other insects.

KENNEDY (J. S.). **Lethal Concentration and Mode of Action of Copper Sulphate used as a Mosquito Larvicide.**—*J. econ. Ent.* **34** no. 1 pp. 86–89, 6 refs. Menasha, Wis., 1941.

Tests of copper sulphate as a mosquito larvicide were carried out on the northern German and Portuguese strains of *Anopheles maculipennis*, Mg., var. *atroparvus*, van Thiel, using the technique described by Bates [*R.A.E.*, B **28** 29; **29** 96]. The media were distilled water and Medium S [**29** 97]. Most larvae survived for three days in the presence of 1 part anhydrous copper sulphate in 50,000, but very few could reach the second instar unless the dilution was as much as 1 part in 500,000. The average survival rates were much higher in Medium S than in distilled water, but the results with the latter were very erratic. It was shown that copper sulphate at 1 : 50,000 can poison the larvae directly, apart from its effect on the microfauna. At lower concentrations, destruction of the food supply may influence survival. Copper carbonate was precipitated when copper sulphate at 1 : 10,000 was added to tap water and to water from a ditch in Albania in which *A. maculipennis typicus* abounds in summer. In experiments in which

larvae of *A. m. atroparvus* of the Hamburg strain were kept in dishes of the ditch water with the addition of copper sulphate at 1 : 10,000, 1 : 50,000 and 1 : 100,000, all died, whereas in the water without copper sulphate, 82 per cent. survived, and in Medium S with the addition of copper sulphate at 1 : 100,000, about 80 per cent. survived. The increased kill is probably due to the ingestion of copper in larger quantities when it is present in the solid form.

SIMMONS (S. W.). **Removal of *Gasterophilus* Eggs from Horse Hair.**—*J. econ. Ent.* **34** no. 1 pp. 116–117. Menasha, Wis., 1941.

In view of the fact that eggs of *Gastrophilus* (*Gasterophilus*) *nasalis*, L., and *G. intestinalis*, DeG., on the hair of horses remain attached to the hair when it is processed for commercial use, tests were made of the suitability of a large number of substances for removing them. The hair was immersed in the potential solvents, and if the eggs were removed, the tensile strength of the hair was then tested as an index of injury. Deviation of this factor from the normal seemed to reflect other damage. Most of the substances tested were ineffective. Of the others, boiling hydrochloric, sulphuric and nitric acids at 1–20 per cent. and 5 per cent. solutions of sodium hydroxide or potassium hydroxide removed the eggs but damaged the hair. Immersion for 6–7 hours in a 0·5 per cent. aqueous solution of 1–100 commercial trypsin at a pH of 7·2–8·0 and at a temperature of 38°C. [100·4°F.] hydrolysed the cement that attaches the eggs without impairing the natural qualities of the hair. The few eggs that remained after this treatment could be removed by spraying with a strong stream of water. Weaker solutions were effective if immersion was prolonged. With a 0·25 per cent. solution, immersion for 24–30 hours was necessary. Using a solution stronger than 0·5 per cent. did not appreciably decrease the time required. Decrease in temperature or pH increased it. Trypsin solution gradually loses its effectiveness with repeated use. In a test with a 0·5 per cent. solution, the time required to remove the eggs increased from 6 hours when it was first used on 17th April to 15 hours when it was used for the fifth time on 21st and 74 when it was used for the seventh time on 26th. The solution was stored at 5·6°C. [42·08°F.] between trials. A non-inactivating bacteriostatic substance must be added to the solution to prevent reduction of hydrolysing properties by bacterial growth during use. About 1 gm. thymol per 100 cc. solution was found to be satisfactory for this purpose. It is believed that the method described is suitable for the removal of *Gastrophilus* eggs from detached commercial horse hair, but it is not known whether it would be adaptable for the removal of eggs from hair remaining on the hide.

KNOWLTON (G. F.) & STAINS (G. S.). **Psocids infest Chinchillas in Utah.**—*J. econ. Ent.* **34** no. 1 pp. 118–119, 1 fig. Menasha, Wis., 1941.

An examination of the nests of some chinchillas that were being bred in Utah and had been seriously damaging their fur by scratching and biting revealed the presence of numerous small, wingless Psocids of the genus *Liposcelis*, one flea, two pseudoscorpions and a few Dermestid larvae. The annoyance appeared to be caused by the Psocids,

though they were very difficult to find in the dense fur of the chinchillas. It is possible that the species may have been introduced into the United States with chinchillas.

HOBSON (R. P.). **The Control of Sheep Maggots.**—*Agriculture* **48** no. 1 pp. 15–19. London, 1941.

Emphasis is laid on the importance of examining sheep at frequent intervals to avoid loss through the effect of attack by blowflies, chiefly *Lucilia sericata*, Mg., which are severe pests in many parts of Great Britain. On lowland farms in badly infested districts, a daily examination is considered necessary. The signs of irritation, which are the chief indication of infestation, are best seen if the sheep are watched in the field before they have been rounded up and become excited. The conditions that make sheep susceptible to attack are given [*R.A.E.*, B **25** 282], and four ways of preventing strike are recognised. Of these, the breeding of immune strains of sheep is considered impracticable in Great Britain, though a considerable difference in susceptibility exists among British breeds, and it is thought that a reduction in the blowfly population, an aspect of the problem on which more research is needed, would at present be best effected by killing all maggots on sheep. The other two methods, preventing the sheep from becoming susceptible and protecting them by the application of chemicals, are discussed at greater length. Susceptibility can to a large extent be avoided by regulating grazing and dosing against worms to prevent scouring, by crutching [**25** 218], the advantages of which are shown by the results of an experiment carried out in North Wales, and by cutting down bracken, which wets the fleece and makes it difficult to find all infested sheep. Chemicals may be used as repellents, insecticides or antiseptics [**26** 192; **29** 100], but antiseptics are practically useless against strike in the tail region, as the loose dung of a scouring animal is highly attractive owing to bacterial action in the intestine, and the value of repellents is limited by the fact that they are usually effective for 10–14 days only. Therefore, the most reliable protective agent is an insecticide.

Chemicals may be applied in four ways. Spraying penned sheep in a group with a mist is only suitable for repellents, as the spray does not penetrate the fleece, but might be adopted in the case of animals that are penned frequently, such as fattening lambs. Spraying individually with a jet under high pressure might be extensively used on large farms for treating the region round the tail, but the cost of the outfit is a disadvantage for small farms. Dusting is suitable for small numbers of sheep and is under investigation. The most popular method is dipping. The dip must be kept clean if it is to be effective, and changed at intervals when large numbers of sheep are being dipped, as the suint that remains in it alters its properties and decreases the retention of the liquid by the fleece. Care should be taken that the sheep do not become soiled with faeces before immersion, and each animal should be in the bath for at least 30 seconds. Mixtures of arsenic and sulphur are most commonly used. When double dipping is necessary, arsenic should be used for both dippings, as if arsenic is followed by a carbolic dip, most of it is washed out and the sheep are susceptible to attack within a few days. Care should be taken that the mixtures are used at the correct strength and well mixed, as severe damage to the skin is

probable if the dip is too strong, or unwetted particles float on the surface. Where infestation is likely to be heavy, sheep and lambs should be regularly dipped after shearing at intervals of 4–6 weeks. Crutching should protect the sheep up to shearing time, except where body strikes are apt to occur early in the season. These should be prevented by dipping 3–4 weeks before shearing. The severe infestation that often occurs between washing and shearing can only be avoided, short of omitting the washing, by shearing within 3–4 days of it.

Infested sheep should be treated with a view to killing all maggots, healing the wound as soon as possible and protecting it from reinfestation. A dressing that rapidly kills maggots should be applied around the wound before the wool is shorn. A good dressing is one composed of 5 parts (by volume) Lysol, 4 parts carbon tetrachloride (commercial) and 11 parts kerosene, diluted for use by pouring one part of the mixture into 4 parts water. The usual method of preventing small biting flies from visiting the wound is to apply Stockholm tar.

ADAMSON (A. M.). **The Geographical Distribution of Insect Pests.**—*Trop. Agriculture* **18** no. 3 pp. 43–47, 4 refs. Trinidad, 1941.

In the course of this paper on various problems relating to the spread, chiefly by human agency, of insects from one country to another [*cf. R.A.E.*, A **29** 543], attention is drawn to the difficulties arising out of increased speed in transport, particularly transport by aircraft [B **28** 83], which is believed to have been responsible for the introduction of *Anopheles gambiae*, Giles, into Brazil, where it has caused serious epidemics of malaria [**27** 125]. The chief danger is thought to be that insects board aircraft on the ground and not that they are carried into them with articles for transport. Examples are given of measures that have been adopted to combat this, but efficient systems of control along many of the great air routes of the world have not yet been adopted. Instances cited of the eradication of insects from invaded territory include the eradication of Anopheline mosquitos from Barbados.

GABALDON (A.). **Estudios sobre anofelinos. Serie I. 1. Descripción de** *Anopheles* (*Nyssorhynchus*) *nuñez-tovari* **n. sp. y consideraciones sobre una sub-división del grupo** *Nyssorhynchus* (**Diptera, Culicidae**). [Studies on Anophelines. Series I. 1. Description of *A. nuñez-tovari*, sp. n., and Notes on a Subdivision of the Group *Nyssorhynchus*.]—*Publ. Div. Malariol.* no. 5 pp. 3–7, 2 figs., 3 refs. Caracas, 1940. (With a Summary in English.)

Anopheles nuñez-tovari, sp. n., is described from a male reared from a larva taken in Venezuela, and a division into subseries is proposed for a series of species of the *Nyssorhynchus* group. The series in question is called by the author the *albimanus* series (it is the *tarsimaculatus* series of Edwards [*cf.* below, p. 181]). It is divided into three subseries based on characters of the male hypopygium, *viz.*: subseries *albimanus*, including only *A. albimanus*, Wied.; subseries *triannulatus*, including *A. triannulatus*, Neiva & Pinto, and *A. strodei*, Root; and subseries *oswaldoi*, including *A. oswaldoi*, Peryassú, *A. aquasalis*, Curry, *A. anomalophyllus*, Komp, and *A. nuñez-tovari*. A key, also based on the male hypopygium, is given to the species of the subseries *oswaldoi*.

GABALDON (A.), COVA-GARCÍA (P.) & LÓPEZ (J. A.). **Estudios sobre anofelinos. Serie I. 2.** *Anopheles* (*Nyssorhynchus*) *rangeli*, **una nueva especie de la subserie** *oswaldoi* **(Diptera, Culicidae) de amplia distribución en Venezuela.** [Studies on Anophelines. Series I. 2. *A. rangeli*, a new Species of the Subseries *oswaldoi*, widely distributed in Venezuela.]—*Publ. Div. Malariol.* no. 5 pp. 9–23, 13 figs., 5 refs. Caracas, 1940. (With a Summary in English.)

The egg, larva, pupa and male hypopygium of *Anopheles rangeli*, sp. n., are described from material taken in Venezuela. In previous work on Anophelines in Venezuela, this species, which is widely distributed there, has been referred to as *A. tarsimaculatus*, Goeldi [*R.A.E.*, B **27** 43; **28** 45, etc.]. *A. aquasalis*, Curry, also occurs at the type locality, but it breeds in brackish water, while *A. rangeli* breeds in fresh water. The senior author's key to the males of the subseries *oswaldoi* [see preceding abstract] is revised to include *A. rangeli*. A key is also given to the larvae of *A. oswaldoi*, Peryassú, *A. aquasalis* and *A. rangeli*. The authors have not seen the larva of *A. anomalophyllus*, Komp, and that of *A. nuñez-tovari*, Gabaldon, has not been studied.

GABALDON (A.), COVA-GARCÍA (P.) & ARÉVALO (A.). **Estudios sobre anofelinos. Serie I. 3. Observaciones sobre número de huevos, salinidad de criaderos y tiempo de desarrollo de tres especies de la sub-serie** *oswaldoi*. [Studies on Anophelines. Series I. 3. Observations on the Number of Eggs, the Salinity of the Breeding Places and the Length of the Life-cycle of three Species of the *oswaldoi* Subseries.]—*Publ. Div. Malariol.* no. 5 pp. 25–32, 6 refs. Caracas, 1940. (With a Summary in English.)

A study was made in Venezuela of the number of eggs laid by *Anopheles aquasalis*, Curry, *A. oswaldoi*, Peryassú, and *A. rangeli*, Gabaldon, Cova-García & López, the salinity of their breeding places and the length of time they require to develop from egg to adult. Curry [in Panama (*R.A.E.*, B **20** 93)] found larvae of *A. aquasalis* in breeding places with 3 to 66·8 per cent. sea water and always found *A. oswaldoi* [called by him *tarsimaculatus* var. *aquacaelestis* (*cf.* also **22** 31)] in fresh-water breeding places. The other species of the *oswaldoi* subseries are not known to have been taken in salt water. It is therefore possible to separate one of these closely-allied species by its breeding place. In Venezuela, the larvae of *A. aquasalis* were found in open, sunny breeding places near the sea-shore with scant vegetation, in water containing 1·7 per cent. sodium chloride. The larvae of *A. rangeli* were always found in fresh water, generally in a dark place with abundant vegetation. *A. aquasalis* developed in fresh water in the laboratory, and the larvae were not affected by a sudden change from salt to fresh water. Larvae of *A. rangeli* died when transferred to water with a sodium-chloride content between 0·05 per cent. (the weakest solution used) and 1·7 per cent. Eggs of this species failed to hatch in water containing 0·85 or 1·7 per cent. sodium chloride; they hatched in water containing 0·05–0·42 per cent., but the larvae did not survive. The average numbers of eggs in batches laid by females of *A. aquasalis*, *A. oswaldoi* and *A. rangeli* taken in nature were 152·6, 129·2 and 80·3, respectively, with minima of 71, 32 and 23 and maxima

of 271, 228 and 217. The lengths of the larval and pupal stages of the three species, when reared at temperatures ranging from 17 to 26°C. [62·6 to 78·8°F.], averaged 14 and 3, 23 and 2, and 19 and 2 days, respectively, and the egg stage lasted for an average of 3 days in each case. The rearing technique is described.

GABALDON (A.), LÓPEZ (J. A.) & OCHOA-PALACIOS (M.). **Estudios sobre anofelinos. Serie I. 4. Variaciones curiosas de cuentas diarias de anofelinos en trampas-establo.** [Studies on Anophelines. Series I. 4. Strange Variations in Daily Counts of Anophelines in Stable Traps.]—*Publ. Div. Malariol.* no. 5 pp. 33–39, 2 refs. Caracas, 1940. (With a Summary in English.)

It has been found on many occasions that more Anophelines are caught on the first night on which a stable trap [*R.A.E.*, B **23** 302] is operated than on the second, and on the second than on the third, after which the number remains fairly constant. Experiments were carried out in two stations in Venezuela to determine whether the decreasing numbers taken during the first three nights reflected a progressive decrease in the Anopheline population in the neighbourhood of the trap. At the first station, observations were made between 27th November and 30th December 1938. A donkey was placed in the trap at 5 p.m. and the collection made at 7 a.m. The trap was left in the same position for three nights, after which it was moved 10 ft. This procedure was repeated ten times. The whole experiment was carried out within an area of about 430 sq. ft. The number of mosquitos caught was much greater on the first night than on the second and usually greater on the second than on the third. On the first night after the trap had been moved, however, the catch was greater than on the two previous nights. Most of the individual species taken were more abundant on the first than on the second and third nights. There were exceptions in certain observations, but they were always associated with small catches. At the second station, six observations were made between 20th April and 11th May 1939. The results were about the same as at the first, although the numbers taken were smaller, and there was no evidence that the trap reduced the local Anopheline population. At the first station, the trap was left in operation for a further six nights at the end of the tenth observation; the numbers of Anophelines caught were comparable with those for the second and third nights.

GABALDON (A.), OCHOA-PALACIOS (M.) & PÉREZ-VIVAS (M. A.). **Estudios sobre anofelinos. Serie I. 5. Observaciones sobre lecturas de trampas-establo con cebo animal.** [Studies on Anophelines. Series I. 5. Observations on Catches in Stable Traps with Animal Bait.]—*Publ. Div. Malariol.* no. 5 pp. 41–56, 2 refs. Caracas, 1940. (With a Summary in English.)

The advantages of the stable trap [*R.A.E.*, B **23** 302] as a means of catching Anophelines are given, and the trap is described. Such traps provide information on the density of zoophilous species in a district and on the efficiency of anti-larval measures. They have been employed since 1927 in Venezuela, where they are useful in the districts in which *Anopheles albimanus*, Wied., is the chief vector of malaria, but not in those in which the vector is *A. darlingi*, Root, as this species is not

zoophilous and therefore is seldom taken in a trap. In the experiments described in this paper, which were carried out to determine whether an appreciable proportion of the Anophelines escape from the trap before the catch is counted at about 7 a.m., less than 3 per cent. of the mosmosquitos taken escaped before sunrise.

GABALDON (A.), HERRERA (J.), PÉREZ-VIVAS (M. A.) & RAUSSEO (J. A.). **Estudios sobre anofelinos. Serie I. 6.** *Chagasia bathanus* **Dyar, 1928 : su hallazgo en Venezuela, y nota sobre variaciones morfológicas de las pupas.** [Studies on Anophelines. Series I. 6. The Finding of *C. bathanus* in Venezuela and a Note on Morphological Variations in its Pupae.]—*Publ. Div. Malariol.* no. 5 pp. 57–62, 3 figs., 6 refs. Caracas, 1940. (With a Summary in English.)

The finding in Venezuela of *Chagasia bathanus*, Dyar, the first species of the genus to have been recorded there, brings the total number of Venezuelan species of Anophelines to 25. Edwards' keys to the adults and larvae of the Anopheline genera, Dyar's key to the adults of the three species of *Chagasia*, an original key to their larvae and Senevet's key to the pupae are given. The larvae of *C. bathanus* were found along the banks of small streams of clear water under trees that allow the rays of the sun to penetrate for a few hours only or not at all. The rate of flow at the banks is nearly nil owing to the vegetation. The larvae were associated with those of *Anopheles argyritarsis*, R.-D., *A. apicimacula*, D. & K., *A. rangeli*, Gabaldon, Cova-García & López, or *A. neomaculipalpus*, Curry.

Notes are given on the morphology of the larvae and pupae. The pupae corresponded in general with the description of *C. bathanus* by Senevet [*R.A.E.*, B **22** 140], but differed in certain characters, which are discussed. The cases that enclose the male hypopygium are of two different types, one similar to that of *C. bonneae*, Root, and the other to that of *C. fajardoi*, Lutz, according to Root's description [**15** 228]. The shape of these cases is evidently not a specific character, as males with identical hypopygia typical of *C. bathanus* were obtained from pupae of both types [*cf.* **19** 187].

GABALDON (A.) & AGUILERA (C.). **Estudios sobre anofelinos. Serie I. 7. Variaciones del color de las especies venezolanas de la sub-serie** *oswaldoi* **(Diptera, Culicidae).** [Studies on Anophelines. Series I. 7. Colour Variations in the Venezuelan Species of the *oswaldoi* Subseries.]—*Publ. Div. Malariol.* no. 5 pp. 63–82, 5 figs., 14 refs. Caracas, 1940. (With a Summary in English.)

In a study of the size of the spots on the wings and tarsi of *Anopheles oswaldoi*, Peryassú, *A. aquasalis*, Curry, *A. nuñez-tovari*, Gabaldon, *A. rangeli*, Gabaldon, Cova-García & López, and the species subsequently described as *A. goeldii* [see next abstract], a great variation was found in their relative length, not only in each species, but in individuals bred from the same female. It is, therefore, practically impossible to differentiate these species by colour when they occur together in the same locality [*cf. R.A.E.*, B **16** 240]. *A. oswaldoi* can always be distinguished from *A. aquasalis*, but the darkest individuals of the former and lightest of the latter may be confused with the other three, which are practically indistinguishable by colour from one another.

ROZEBOOM (L. E.) & GABALDON (A.). **A Summary of the "*Tarsimaculatus*" Complex of *Anopheles* (Diptera : Culicidae).**—*Amer. J. Hyg.* **33** (C) no. 3 pp. 88–100, 4 pls., 21 refs. Lancaster, Pa., 1941.

The mosquitos dealt with in this paper are *Anopheles oswaldoi*, Peryassú, *A. aquasalis*, Curry, *A. anomalophyllus*, Komp, *A. nuñeztovari*, Gabaldon, *A. rangeli*, Gabaldon, Cova-García & López, and a species collected along the Rio Tapajos, Boa Vista, Brazil, and also in a town on the southern shore of Lake Maracaibo, in Venezuela, and here described (from adults of both sexes, larva and egg) as *A. goeldii*, sp. n. ; and notes are included on the use of the name *A. tarsimaculatus*, Goeldi, by various authors. The characters of the male genitalia separating members of this complex, and the characters of the eggs separating *A. oswaldoi*, *A. rangeli*, *A. aquasalis* and *A. goeldii* are discussed. The authors consider that the name *A. tarsimaculatus* is nomenclatorially invalid under Article 32 of the International Rules and that its use for the mosquito supposed to be that figured by Goeldi when he proposed it is inadmissible [*cf. R.A.E.*, B **21** 149]. Goeldi's figures are of a species from Para of which the male and larva are unknown. The apparent similarity of the eggs might suggest that it is *A. goeldii*, but it may prove to be an undescribed species. *A. aquasalis* is the correct name for the species from Panama called *A. tarsimaculatus* [**22** 31]. The application of the name *A. gorgasi*, D. & K., to *tarsimaculatus* [*cf.* **21** 149] or to *A. aquasalis* is probably incorrect. *A. gorgasi* was described from a battered female collected on the Pacific side of the Isthmus of Panama, *A. aquasalis* being found only on the Atlantic side.

MACFIE (J. W. S.). **Notes on Ceratopogonidae (Diptera).**—*Proc. R. ent. Soc. Lond.* (B) **10** pt. 5 pp. 67–69, 2 figs. London, 1941.

Two new species of Ceratopogonids are described, one of which, *Culicoides victoriae*, was taken biting man in Victoria, Australia. Notes are also given on four Malayan species of *Culicoides* taken while feeding on cattle, including the male of one of them, *C. shortti*, Smith & Swam., which had not previously been collected.

BUXTON (P. A.). **The Parasitology of Scabies.**—*Brit. med. J.* 1941 no. 4211 pp. 397–401, 5 figs., 16 refs. London, 1941.

CARTER (D. L.). **Treatment of Scabies. Use of Sulphur Lather Tablets.**—*T. c.* pp 401–403, 16 refs.

MACKENZIE (I. F.). **Scabies treated by a Benzyl Benzoate Emulsion.**—*T. c.* pp. 403–405, 9 refs.

MELLANBY (K.). **The Transmission of Scabies.**—*T.c.* pp. 405–406, 2 refs.

The following is substantially the author's summary of the first paper, which is an account, based largely on the literature, of the morphology, life-history and relation to man of *Sarcoptes scabiei*, DeG., the causal organism of scabies. The mite is a specific parasite of man, and can live for only a short time away from its host. The minimum length of the life-cycle from egg to adult is 8 days. It seems probable that two types of burrow are made, one by the larva, with a vesicle in the floor, and the other by the nymphs. It is in those of the second

type that adults, eggs, etc., are found. Infestation is usually derived from another human being, but occasionally man becomes infested with the *Sarcoptes* of horse, camel, etc., which appear to set up a transient form of the disease. Crusted scabies [*cf. R.A.E.*, B **9** 148] is sometimes due to prolonged neglect of ordinary scabies [**18** 23], but there are cases that are probably due to infestation by *Sarcoptes* from some host other than man [**16** 82].

The fourth paper contains descriptions of experiments made to ascertain the normal method of transmission. Out of 63 volunteers who for a week slept, usually naked, in blankets or wore underclothing previously used by persons suffering from scabies, only 2 out of the 32 who used underclothing immediately after it was removed from the patient developed scabies, though everything was done to favour transmission. Personal contact was tested on four occasions by letting an uninfested volunteer sleep in the same bed as one or other of these men, 2–3 months after the infestation had been transmitted to them. Both had general but not severe infestations on the body. The men wore pyjamas. In three instances, the men slept together for seven nights and mites were found on the previously uninfested ones 8, 9 and 12 days, respectively, after the beginning of the experiment. In the fourth case, the men slept together for two nights without transmission occurring. It is concluded that scabies is normally transmitted by personal contact, and that cases in the Army are usually contracted while the men are on leave. The evidence is not sufficient to justify a statement that disinfection of clothing and blankets is unnecessary in cases of scabies, but it is thought probable that this is the case.

PULLAR (E. M.). **Mange or Scabies of Pigs.**—*J. Dep. Agric. Vict.* **39** pt. 3 pp. 99–104, 126, 7 figs. Melbourne, 1941.

The symptoms of mange in pigs and the mite [*Sarcoptes suis*, Gerl.] that causes it are briefly described, and it is pointed out that mange not uncommonly exists in a mild and unrecognised form, particularly among older pigs, and that these lightly infested animals act as a source of infestation for others. The male and unfertilised female mites live under the scabs on the skin. After fertilisation, the females burrow into the skin and lay their eggs in the tunnels. The newly hatched larvae go to the surface, and both larvae and nymphs feed under the scabs. Each female lays 10–25 eggs. The egg stage lasts 3–4 days and the complete life-cycle about 15. The harm done to the pigs is threefold. The skin is directly injured ; and the irritation set up causes the pigs to injure it further and to bruise themselves by biting and rubbing, and also to lose sleep and consequently condition. In a lightly-infested herd, the pigs required twice as much food to gain 1 lb. in weight as they would under normal circumstances.

To control the mange, it is most important that animals found to be infested with mites and those that have been in contact with them should be isolated. It is recommended that lightly infested pigs almost up to market weight and boars and sows with other faults should be sold for immediate slaughter, and badly infested animals in poor condition destroyed on the farm, as the expense of treating them would not be justified. The others should be treated with some chemical. In recent field trials in Victoria using 20 pigs, tests were made of three new treatments : a strong solution of hypo [sodium thiosulphate] left to dry on the skin for 5–10 minutes and followed by a solution of spirits

of salts [hydrochloric acid] to free the sulphur; and an emulsion of neat's-foot oil [*R.A.E.*, B **29** 61] containing either 1 per cent. derris powder or 1·5 per cent. sulphur. All treatments were repeated three times at intervals of four days as they do not kill the eggs. The hypo and the oil and derris effected considerable improvement, but not a complete cure; moreover the former left the skin under the detached scabs harsh and dry, and the latter had to be applied with a brush as the derris curdled the emulsion. The oil and sulphur gave complete control, leaving a clean and healthy skin seven days after the last treatment. If the sulphur is replaced by sulphurated potash [potassium sulphide] the difficulty of grinding it in the oil is overcome. The recommended mixture is prepared by adding 1 oz. sulphurated potash and two teaspoonfuls washing soda to two quarts soft water, bringing to the boil and stirring in one quart neat's-foot oil when the solids have dissolved and the container has been removed from the fire. It can be used as soon as it is cool or stored till required. The dressing is applied with a spray pump. If the pigs are driven together in a confined space, no further restraint is necessary. The spray must reach the whole body including the head. The emulsion does not irritate the eyes, but the full force of the jet should not be turned on to them until they are closed. One man can treat 15–20 pigs in an hour. On well kept piggeries, treatment of surroundings should be unnecessary, but on others thorough disinfection is required. After the disease has apparently been eradicated, it is wise to treat all sows before farrowing and the sucking pigs before weaning and to make a thorough examination of the herd at regular intervals for about six months.

STEWART (W. L.). **The Sheep Tick. A Survey of Conditions in the four northern Counties of England.**—*J. R. agric. Soc. Engl.* **101** pt. 2 pp. 57–62. London, 1941.

Much of the information in this paper has been noticed from another source [*R.A.E.*, B **28** 52]. A survey of the causes and extent of loss occasioned among sheep and cattle by *Ixodes ricinus*, L., in the four northern counties of England, carried out in 1940, showed that there are about 800 sq. miles of tick-infested grazing land within this area, mostly at altitudes of 400 to 2,000 ft. There are other large areas of infestation in England, Scotland and Wales. The four diseases that are known to be carried by this tick, *viz.*, louping-ill in sheep and cattle, redwater fever [caused by *Piroplasma bovis*] in cattle, tick-borne fever in sheep and tick pyaemia in lambs, all occur in the tick-infested regions in the north of England. Tick pyaemia and tick-borne fever seem to be prevalent throughout them, and louping-ill and redwater fever to be confined to about half the areas. There were indications that the diseases of cattle occurred in isolated patches, while those of sheep if present in an area were spread throughout it. Pyaemia is the most important tick-borne disease of lambs. The answers received to a questionnaire circulated among 900 farmers in the north of England showed the death-rate among sheep in tick-free areas, all tick-infested areas and heavily infested areas to be 3·2, 7·3 and 9·3 per cent., respectively, during the spring of 1939. On certain farms where no control measures were taken, as many as 20 to 60 per cent. of the lambs died before autumn. It was found that the presence of ticks on farms often led to a lowering of the rent and that many hill farms in infested areas are in danger of becoming derelict.

The spread of ticks, which is comparatively slow, is nearly always connected with movement of infested sheep or with the breakdown of a boundary fence and consequent straying of stock. The ticks can only become established where the vegetation is long and thick enough to provide cover with a very high humidity. A considerable reduction in their numbers would therefore result from the improvement of hill pastures by draining, moor burning, bracken eradication and mixed grazing with cattle. However, this is a costly measure, and for practical purposes, dipping of the entire flock 4–8 days before lambing, with a good anti-tick dip, which will confer comparative freedom for about three weeks, and the application of derris dust to the newly-born lambs, and again at intervals of three or preferably two weeks until the end of the spring season of tick activity, are recommended [*loc. cit.*].

Papers noticed by Title only.

Hubbard (C. A.). **A Check List of the Fleas of the Pacific Northwest (Washington, Oregon, northern California and northwestern Nevada) with Notes from southern California.**—*Pacif. Univ. Bull.* **37** no. 4, 4 pp. Forest Grove, Ore., 1940.

Aitken (T. H. G.). **A new American Subgenus and Species of** *Aëdes* **(Diptera, Culicidae)** [*Kompia purpureipes*, subgen. et sp. n., described from females from Lower California and Arizona].—*Pan-Pacif. Ent.* **17** no. 2 pp. 81–84. San Francisco, Calif., 1941.

Vogelsang (E. G.) & Cordero (E. H.). **Las garrapatas (Ixodidae) de Venezuela.** [The Ticks (Ixodoidea) of Venezuela.]—*Rev. Med. Vet. Parasit.* **2** no. 1–2 pp. 71–76, 5 refs. Caracas, 1940.

Hitchcock (F. A.) & Haub (J. G.). **The Interconversion of Foodstuffs in the Blowfly (*Phormia regina*) during Metamorphosis. I. Respiratory Metabolism and Nitrogen Excretion.**—*Ann. ent. Soc. Amer.* **34** no. 1 pp. 17–25, 3 figs., 14 refs. Columbus, Ohio, 1941.

Patton (M. B.), Hitchcock (F. A.) & Haub (J. G.). **The Interconversion of Foodstuffs in the Blowfly (*Phormia regina*) during Metamorphosis. II. Changes in Composition as determined by the Oxycalorimeter.**—*Ann. ent. Soc. Amer.* **34** no. 1 pp. 26–31, 1 fig., 3 refs. Columbus, Ohio, 1941.

Haub (J. G.) & Hitchcock (F. A.). **The Interconversion of Foodstuffs in the Blowfly (*Phormia regina*) during Metamorphosis. III. Chemical Composition of Larvae, Pupae and Adults.**—*Ann. ent. Soc. Amer.* **34** no. 1 pp. 32–37, 4 refs. Columbus, Ohio, 1941.

Hassall (A.), Doss (M. A.), Taylor (R. M.), Carson (G. B.) & Segal (D. B.). **Index-catalogue of Medical and Veterinary Zoology. Part 5. Authors : E to Fynney.**—pp. 1177–1458. Washington, D.C., U.S. Dep. Agric., 1941. Price 45 *cts.* (from Supt. Documents). [*Cf. R.A.E.*, B **28** 257.]

EAGLESON (C.). **Bioassay of Livestock Spray using hypnotic Doses applied in a Spray Tunnel.**—*Soap* **17** no. 5 pp. 101, 103, 105, 107, 1 fig., 8 refs. New York, N.Y., 1941.

The Peet-Grady method of testing the toxicity of fly-sprays is unsuitable for those applied to cattle because the fumigatory conditions are not comparable with those in well-aired barns. A method of testing in a spray tunnel in which natural conditions are simulated was developed in Texas [*R.A.E.*, B **28** 240]. The author, however, considers that knockdown is better than kill as a basis of evaluation, as the difference in the susceptibility of the sexes of *Musca domestica*, L., to doses of pyrethrins regulated to produce typical symptoms in all the insects and yet allow practically complete recovery (hypnotic dose) was found to be very slight, whereas the difference in susceptibility to a lethal dose is considerable [**26** 86].

Experiments are described in which the dosage-mortality regression for the toxicity of pyrethrins to *M. domestica* obtained by a modified Peet-Grady method, the dosage-mortality regression obtained in a spray tunnel and the dosage-torpor regression obtained by using a hypnotic dose in the same apparatus are compared. The flies were placed for observation in a recovery cabinet through which a constant stream of air was circulated. The spray-tunnel technique is considerably more rapid than the Peet-Grady method. It seems probable that recovery from a hypnotic dose of pyrethrins represents the same toxicological process as recovery from a median lethal dose. There are several advantages in the use of hypnotic doses in addition to the fact that it is unnecessary to determine the sex ratio of more than a small sample. Owing to the short period of observation, mortality due to causes other than the treatment is almost nil; the observations and counts are made without removing the flies from the cylinder; and the ease and rapidity with which repetitions can be made facilitates statistical precision. Since the ability of flies to recover from mild doses of sprays is a factor limiting efficiency, the study of that recovery is important. Such a study is facilitated by the method described.

VANDERPLANK (F. L.). **A Note on the Relation between the Virulence of *Trypanosoma rhodesiense* towards Rats and the normal Blood Temperature of its previous Mammalian Host.**—*Trans. R. Soc. trop. Med. Hyg.* **35** no. 1 pp. 43–46, 1 ref. London, 1941.

An experiment carried out in Tanganyika, the results of which are shown in tables, indicated that the transmissibility of *Trypanosoma rhodesiense* by *Glossina morsitans*, Westw., and its virulence in rats may be increased by passage through animals with a low mean body temperature. The rectal temperatures of 2–6 individuals of each of the eight mammals used in the study were taken before they were infected. The percentage of *G. morsitans* that became infected and the mean length of life in days of rats infected by them were 1·5 and 66·80 when the trypanosome had passed through sheep, which had the highest mean body temperature (103·4°F.) and 9·6 and 30·54 when it had passed through Thomson's gazelle, which had the lowest (98·7°F.). In a subsidiary experiment in which the flies were fed on an ant-bear (*Orycteropus afer*), the mean temperature of which was 97·0°F., 2 per cent. became infective, and two rats infected by one of these lived 16 and 20 days.

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SUMMERS (W. A.). **Fleas as acceptable intermediate Hosts of the Dog Heartworm,** *Dirofilaria immitis.*—*Proc. Soc. exp. Biol. Med.* **43** no. 3 pp. 448–450, 3 refs. New York, N.Y., 1940.

Microfilariae of *Filaria* (*Dirofilaria*) *immitis* were found in examples of *Ctenocephalides canis*, Curt., *C. felis*, Bch., and *Pulex irritans*, L., taken on infected dogs in New Orleans. In the case of each species of flea, the females were more heavily infected than the males. In some instances, all the females from a dog were infected. In experiments, the filarial larvae completed their development in all three species of flea [*cf. R.A.E.*, B **9** 76], the time required being 120 hours in warm and 216 hours in cold weather, as compared with a minimum of 240 hours in mosquitos.

HEWITT (R.) & KOTCHER (E.). **Observations on Household Anophelism in a selected Group of Mosquito-proofed and Non-mosquito-proofed Homes.**—*Publ. Hlth Rep.* **56** no. 20 pp. 1055–1061, 1 fig., 6 refs. Washington, D.C., 1941.

Studies were made during June, July and August 1940 on the number of Anophelines (*Anopheles quadrimaculatus*, Say) in 38 houses in three communities in the Tennessee Valley, Alabama, in two of which the houses had been made mosquito-proof. The houses chosen for observation were usually at least a third of a mile and not more than half a mile from a major Anopheline breeding place, and were comparable in size and number of inhabitants and usually in the number of outbuildings and kind of livestock kept. Counts were made on three successive days in each week at approximately the same time of day. Throughout June, there was little difference between the numbers of mosquitos found in the proofed and non-proofed houses, all counts being exceedingly low. In July, the average catches in all the communities were much higher. The catch in the non-proofed area (8·03 mosquitos per house per day) was significantly higher than that in one of the treated ones but only slightly higher than that in the other (2·15 and 5·67). However, in the last, the figure was weighted by exceptionally heavy catches in three houses. The average daily catches in August were 6·33 in the non-proofed houses and 1·7 and 1·41 in the proofed ones. Very little significance can be attached to the differences in the number of mosquitos found on each of the three days of the week throughout June since they were exceedingly small. During July, the average catch was markedly higher on Monday than on Tuesday or Wednesday in the non-proofed and one of the proofed areas ; in the other, catches remained very low. In August, also, there was a marked decrease in the number of mosquitos found in houses on the second and third days, in both types of house, though catches in both proofed areas were low. This seems to indicate that over a period of one or two days, mosquitos that enter houses tend to accumulate in them. When stained mosquitos were released in houses, however, the proportion recovered was very small ; it was not appreciably greater from proofed than non-proofed houses. It appears that under the conditions of the experiment performed, most fed females do not remain within either mosquito-proofed or non-mosquito-proofed houses for long periods [*cf. R.A.E.*, B **12** 56]. Only four out of 505 newly emerged mosquitos (about 50 per cent. females) released in proofed houses and one out of 225 released in non-proofed houses were

recovered on the following morning. Mosquitos found in barns during the daytime were almost invariably females that had fed. Of 3,575 mosquitos released in five barns, only 28 were recovered from the same barns on the three following days. No instance of flight from barns to houses about 75 yards away was recorded, and only eight instances of flight from the houses to the barns out of 1,493 mosquitos released in houses.

PATTERSON (T. C.). **Insect Pests in northern Norway. The Mosquito Nuisance.**—*J. R. nav. med. Serv.* **26** no. 4 pp. 346–352, 5 refs. London, 1940.

Attention is drawn to the abundance of mosquitos and other blood-sucking Diptera in the far north of Scandinavia at certain times of the year, the serious discomfort they cause and the necessity of taking adequate precautions to protect men who go to this region. The mosquitos are usually active only at temperatures above 50 and below 70°F., and principally between 9 a.m. and 1 p.m. They prefer still air and damp heat, and are numerous from soon after the last night frost about May until the first night frost about October. They breed in the small pools that appear in great numbers after the beginning of the general thaw; these pools cannot drain because the ground below is still frozen, though they become very warm through exposure to the continuous sunshine of the Arctic summer. On account of the wide areas of wet ground, drainage, clearing and oiling are not practicable as means of control, and relief must be sought by personal protection. The formulae of a number of repellent creams used by the British Navy and Army and mostly containing citronella oil, and notes on the treatment of bites are given, together with descriptions of head nets which, with gauntlet gloves of strong, closely woven linen, should be issued to all personnel who may be exposed to attack. Thick clothes and underclothes must be worn, and living quarters screened. Brief reference is made to insect-borne diseases, and it is pointed out that malaria was widespread in Sweden and Finland early in the nineteenth century, and though no records have been found from Norway, species of *Anopheles* occur there. During the last ten years, considerable numbers of isolated cases and several epidemics of tularaemia, which may be transmitted by mosquitos, have occurred in Sweden and Norway.

NÁJERA ANGULO (L.). **Descripción de un dispositivo nuevo para la cría de** *Phlebotomus*. [Description of a new Apparatus for Breeding *Phlebotomus*.]—*Rev. Med. trop. Parasit.* **7** no. 1–2 pp. 8–12, 1 fig., 14 refs. Havana, 1941.

It has been shown that a very high degree of humidity is not essential for the development of eggs of *Phlebotomus* spp., but that females lay all or nearly all their eggs only if the relative humidity approximates to 100 per cent. In experiments to induce fertilised females to oviposit after a blood meal, the author devised an apparatus, which is described, that ensures this requisite. It consists essentially of a row of glass tubes inverted on corks provided with grooves that allow a certain amount of ventilation and prevent condensation. A strip of fabric is stretched over each cork, and the two ends dip into troughs of water, thus providing a source of humidity. Filter papers are placed on the corks, and if food is supplied, it is placed on these. Parrot observed

the larvae of *P. papatasii*, Scop., feeding on vegetable débris [*R.A.E.*, B **21** 21], and in the author's experiments, larvae of *P. ariasi*, Tonn., and *P. perniciosus*, Newst., also did so. The principal breeding medium used, however, was a paste of water and guineapig faeces cleared of insects and Nematodes.

LANE (J.) & PORTO (C. E.). **Simulideos da região neotropica. III. Descrição de novas especies dos gêneros "*Simulium*" e "*Eusimulium*."**—*Arq. Inst. biol.* **11** pp. 189–195, 16 figs., 3 refs. São Paulo, 1940. (With a Summary in English.)

The new species described are *Simulium scutellatum* from Brazil and Colombia, and *S. pilosum*, *S. major*, *S. albopictum* and *S.* (*Eusimulium*) *antunesi*, all from Brazil. *S. pilosum* and *S. scutellatum* were taken attacking man and *S. major* and *S. antunesi* on animals. A description of the male terminalia of *S. incrustatum*, Lutz, is included.

[PARAMONOV (S. Ya.).] **Парамонов (С. Я.). Flies of the Genus *Gastrophilus* and their Control.** [*In Ukrainian.*]—Med. 8vo, 128 pp., 60 figs., 2 pp. refs. Kiev, Akad. Nauk URSR, 1940. Price 6 *krb.*

A brief survey of the history of the study of *Gastrophilus* spp. and of present knowledge of their bionomics is followed by notes on the characters differentiating the larvae and adults from those of other Diptera, the geographical distribution of the genus, and the biology and morphology of the adults. A list is given of the known species, showing synonymy and the principal references to them in the literature. The adults of the nine species that (with one possible exception) occur in the Russian Union, and the eggs and three larval instars of some of them, are described, and keys to them are included, together with records of their distribution and hosts (horses, donkeys or wild horses) if known. The conditions essential for the hatching of the eggs are discussed, as well as the biology of the larvae and pupae in general and of the larvae of *G. inermis*, Br., *G. pecorum*, F., and *G. meridionalis*, Pillers & Evans, in particular, followed by notes on the artificial breeding of the larvae and their economic importance as pests of horses. Instances observed in the Russian Union of cutaneous myiasis in man caused by the larvae and of their occurrence in the human stomach are cited. Control measures are reviewed, and a short bibliography of the chief Russian and other literature is appended.

MACKERRAS (I. M.), MACKERRAS (M. J.) & BURNET (F. M.). **Experimental Studies of Ephemeral Fever in Australian Cattle.**—*Bull. Coun. sci. industr. Res. Aust.* no. 136, 116 pp., 2 pls., 10 figs., 57 refs. Melbourne, 1940.

In a foreword by L. B. Bull, it is stated that ephemeral fever was first observed in cattle in Australia in the early part of 1936, when its almost simultaneous occurrence was reported in Western Australia, the Northern Territory and Queensland. It had evidently been introduced some months or even years previously, but remained unrecognised. About a year later, it had spread down the east coast as far as the north-eastern border of Victoria. Although cross-immunity tests could not be made, there seems to be no doubt that the disease

in question is identical with the ephemeral fever of cattle that has long occurred in Africa and Asia. As it was thought to be insect-borne, investigations to ascertain the vector were begun at Canberra, but had to be suspended with the onset of cold weather. However, study of the disease was continued, in the hope that the knowledge acquired would facilitate subsequent work on transmission. The results obtained are set out and discussed in this Bulletin.

The subjects dealt with include the clinical features of the disease, pathology, infectivity and immunity, the distribution of the virus in the blood, experiments on filtration and the preservation of the virus *in vitro*, and unsuccessful attempts to pass the infection through Australian merino sheep. The evidence in favour of transmission by some insect that is capable of free movement and flight, which is indirect but strong, is summarised. Attempts to transmit the disease by contact failed, and in the blood-dwelling stage the virus was transmissible with certainty only by the intravenous route. Attempts to transmit the infection mechanically by means of interrupted bites by *Stomoxys calcitrans*, L., *Aëdes vigilax*, Skuse, *A. alternans*, Westw., and *A. notoscriptus*, Skuse, and cyclically by *S. calcitrans*, *A. vigilax*, *A. alternans*, *A. alboannulatus*, Macq., and *Culex annulirostris*, Skuse, were all unsuccessful. In the experiments on mechanical transmission, the intervals between the two bites were at least as short as would ever occur in nature, and few Australian species of blood-sucking Diptera pierce more deeply than *A. alternans*, so that it is thought that results relating to mechanical transmission may be applied generally. With regard to cyclical transmission, it was shown only that neither *S. calcitrans* nor *A. vigilax* is likely to be an efficient vector. The numbers of the other three species available were too small for definite conclusions. Ephemeral fever is shown to be closely related to, but distinct from, human dengue fever. *A. aegypti*, L. (*argenteus*, Poir.), which transmits dengue in Australia [*cf. R.A.E.*, B **19** 152; **20** 149], cannot, by reason of its distribution and domestic habits, be the vector of ephemeral fever. However, as cyclical transmission occurs in dengue and other diseases of the same group, it is inferred that it occurs in ephemeral fever also. It is not known whether the virus simply multiplies in the insect host or passes through a true developmental cycle. As the vector must be of wide distribution and capable of free movement, it is thought that it must be one of the blood-sucking Diptera. The suitability of members of different families is discussed, and it is concluded that the most probable vectors are Ceratopogonids. The results of unpublished studies of D. J. Lee and the authors' own observations on their distribution, ecology and feeding habits, are given in support of this.

[Edwards (F. R.).] **Animal Industry.**—*Rep. Ga Exp. Sta* **52** (1939–40) pp. 39–51, 1 fig. Experiment, Ga. [1940].

Bovicola (*Trichodectes*) *ovis*, L., is sometimes an important pest of sheep in Georgia; when infestation is heavy, the wool drops off in layers and the loss of energy and interference with feeding and nutrition stunt the growth of the young animals and lower the vitality of the entire flock. As a control measure, all animals should be dipped in a good creosote solution immediately after shearing and twice more at intervals of 16 days. The lice can also be eradicated by applying a dust containing sodium fluoride; one application is sufficient if the

dust penetrates to the skin. Sheep ticks [*Melophagus ovinus*, L.] suck blood from the host, causing it to be nervous and to lose weight. It is estimated that the average annual loss in flocks infested by this Hippoboscid is 20 cents per ewe and 25 cents per lamb. It is effectively controlled by the creosote dips recommended against *B. ovis*.

SYVERTON (J. T.) & BERRY (G. P.). **Hereditary Transmission of the Western Type of Equine Encephalomyelitis Virus in the Wood Tick, *Dermacentor andersoni* Stiles.**—*J. exp. Med.* **73** no. 4 pp. 507–530, 2 pls., 3 charts, 37 refs. Baltimore, Md., 1941.

A detailed account is given of two series of experiments in which it was demonstrated that *Dermacentor andersoni*, Stiles, can acquire the virus of the western type of equine encephalomyelitis, pass it to later stages in its life-cycle and to its progeny and transmit it. The methods used are described. The strain of virus employed was recovered in South Dakota, and transmission was made to guineapigs and gophers (*Citellus richardsoni*). Ticks of the genus *Dermacentor* have essentially the same seasonal occurrence and geographical distribution as equine encephalomyelitis, and their habits make them almost ideal vectors or reservoirs for the virus.

In the first series of experiments, adults arising from nymphs that had fed for three days on a guineapig infected by injection were allowed to feed for five days on three normal gophers in lots of four males and four females per animal. Two of the gophers were effectively immunised, and the third died of the disease. Larvae hatching from eggs deposited by the female ticks used in this experiment were allowed to feed on six gophers and six guineapigs in lots of 75–100 per animal. None of the hosts died, but three of each species were immunised. Nymphs that developed from the larvae that transmitted the virus immunised some of the gophers on which they fed in lots of 30. The adults that developed from the infective nymphs were allowed to feed on four gophers and five guineapigs in lots of four males and four females per animal. Three of the animals died, one guineapig of equine encephalomyelitis, and two gophers of what was possibly tick paralysis. One of the surviving gophers was immunised. When larvae from eggs laid by the adults that had transmitted the virus were allowed to feed, all the test animals survived and immunity was only doubtfully established in one. Experiments with ticks that had failed to transmit the virus afforded no evidence that it can reappear in them in a later stage or in their progeny. These results were confirmed in a series of experiments starting with adult ticks.

This is the first proof of transmission of a virus by a species of *Dermacentor* and of hereditary transmission of a virus through more than one stage [*cf.* *R.A.E.*, B **20** 20] in any Ixodid. The ticks that had acquired the virus engorged, moulted and were ready to feed again much more rapidly than normal ticks. They completed their life-cycle in 156 days, whereas at least two years are usually required. The efficiency of *D. andersoni* as a vector as shown in these experiments is compared with that of mosquitos of the genus *Aëdes* [**25** 6, 128; **27** 161]. No vector has been found to date that harbours or transmits the virus of equine encephalomyelitis under natural conditions [but *cf.* **29** 38]. The experiments suggest that ticks maintain the virus from year to year and transmit it to a variety of hosts, especially during the early spring. The heightened incidence

of the disease during the summer and autumn may be accounted for by assuming that the mosquito is the transmitting agent at these times.

ROVEDA (R. J.). **Primera contribución al estudio de la bionomia del** *Argas persicus*. [First Contribution to the Study of the Bionomics of *A. persicus*.]—[*Publ.*] *Inst. Parasit. Enferm. parasit.* **1** fasc. 6, 22 pp. Buenos Aires, 1940.

In view of the importance of *Argas persicus*, Oken, as a pest of fowls in Argentina, the author carried out investigations in 1937–39 on the duration of the egg stage and the period for which the larvae of this tick can survive starvation at various temperatures and humidities. The results, which show considerable variation, are recorded in detail for large numbers of individuals and batches, and it is concluded that the optimum conditions for the development of the eggs are a variable temperature between 22 and 38°C. [71·6 and 100·4°F.] and 90–100 per cent. relative humidity, under which conditions the percentage mortality was only 4·86. At 37–38°C. [98–100·4°F.] and 80–95 per cent. humidity, the percentage mortality was 22·45. The larvae survived without food for up to 228 days at 22–26°C. [78·8°F.] and 90–100 per cent. humidity, but for an average not exceeding about 50 days at 37–38°C. and 85–100 per cent. humidity. In Argentina, favourable conditions for the eggs and larvae occur north of latitude 38°S.

MAZZOTTI (L.). **Experimental Infection of** *Haematosiphon inodora* **(Dugès) with** *Trypanosoma cruzi* **Chagas.**—*Bull. Brooklyn ent. Soc.* **36** no. 2 pp. 67–68, 4 refs. Lancaster, Pa., 1941.

On 20th June 1940, 15 adults of *Haematosiphon inodorus*, Dugès, a Cimicid that infests poultry yards in Mexico and the United States and attacks man as well as fowls, especially when the yards are near bed-rooms, were placed on a mouse lightly infected with *Trypanosoma cruzi* ; 12 of them fed in about 20 minutes, and 4 defaecated less than 5 minutes after feeding. One of the bugs was killed on 5th July and metacyclic forms of *T. cruzi* were numerous in its intestinal contents. Saline suspensions of the intestinal contents of two of the infected bugs were inoculated intraperitoneally into two mice on 11th July, and both the mice became infected, the incubation periods being 11 and 15 days.

WOOD (S. F.). **A Method of collecting and transporting Cone-nosed Bugs.**—*Bull. Brooklyn ent. Soc.* **36** no. 3 pp. 137–139, 1 fig., 2 refs. Lancaster, Pa., 1941.

During investigations on the distribution of *Trypanosoma cruzi* in the south-western United States, large numbers of nests of wood-rats (*Neotoma* spp.) were examined, and an average of 2·88 Triatomids per nest was found in 451 nests. The species represented were *Triatoma protracta*, Uhl., *T. protracta woodi*, Usinger, *T. rubida*, Uhl., *T. gerstaeckeri*, Stål, *T. heidemanni*, Neiva, *T. indictiva*, Neiva, *T. sanguisuga*, Lec., and *Paratriatoma hirsuta*, Barber. The way in which the nest material was raked over and examined in the field is described.

To carry the bugs to the laboratory, cylindrical cartons of heavy cardboard, 2 ins. in diameter and 3 ins. deep, with two side windows, a tin bottom and screw-cap top and a lining of wire gauze were used. The lining was fastened in place with wire. The disadvantages of this container are that the tin becomes very hot if the cartons are left in the sun, and the metal will rust in prolonged contact with moisture. The advantages are that it is small, light in weight (as compared with a glass jar), compact, strong, well ventilated and more resistant to moisture than a thin cardboard box or drug carton. Insects can be put in or removed with forceps, the contents can be seen without removing the cap, the rough inner lining offers a clinging surface, and the fine gauze confines eggs, nymphs or larvae. Double disks of paper towelling on the bottom and a pleated upright piece are placed in each carton to absorb fecal matter. Loss of bugs in transit during very hot weather is reduced if the cartons are placed in a metal gauze basket and covered with wet cloths.

Wood (S. F.). **New Localities for *Trypanosoma cruzi* Chagas in southwestern United States.**—*Amer. J. Hyg.* **34** (C) no. 1 pp. 1–13, 7 figs., 18 refs. Lancaster, Pa., 1941.

A field and laboratory examination for the presence of *Trypanosoma cruzi* was made of the faeces of Triatomids and the blood of bats collected in south-western Texas and regions of New Mexico and Arizona not previously examined [*R.A.E.*, B **26** 144]. The experimental methods are described. Of the 565 examples of *Triatoma* taken alive and examined in 1939, 5·3 per cent. from five localities were found infected; they comprised two examples of *T. protracta*, Uhl., 20 of *T. protracta woodi*, Usinger, two of *T. gerstaeckeri*, Stål, and 6 of *T. longipes*, Barber. The distribution of the bugs collected is given. Of those examined, two *T. longipes* (one infected) came from sleeping bags, 31 *T. longipes* (five infected), three *T. protracta* and nine *T. rubida*, Uhl., came from occupied dwellings, and the remainder were collected from nests of wood rats (*Neotoma* spp.). Natural infection in *T. longipes* and *T. protracta woodi* (the castaneous form of Wood & Wood [**26** 144]) has not previously been recorded. Examples of *T. heidemanni*, Neiva, and *T. indictiva*, Neiva, from Texas were infected experimentally. Infected bugs from three localities were used for inoculating white mice and *Peromyscus californicus insignis*, and the heaviness of the infections produced by the three strains of *Trypanosoma cruzi* is compared. During the summer, the blood of 212 bats representing 10 species was examined for the presence of blood parasites, and trypanosomes, apparently *Trypanosoma vespertilionis*, were found in five bats of three species from three localities.

The only area along the route of investigation in Texas in which Triatomids were reported to be troublesome in houses was the Quemado Valley, where naturally infected examples of *Triatoma protracta woodi* and *T. gerstaeckeri* were found. In Arizona during 1939, a severe infestation of dwellings occurred at the Alvarado and Sullivan Mines near Congress. The Alvarado mine was one of the places in which infected Triatomids were found, and reports of the occurrence there of unilateral palpebral oedema in man, one or two weeks after bites had been received, may be an indication of infection with Chagas' disease.

HUFF (C. G.). **Comparative Importance of various Factors upon the Regulation of Size of Avian Malarial Oöcysts in Mosquitoes.**—*Amer. J. Hyg.* **34** (C) no. 1 pp. 18–21, 7 refs. Lancaster, Pa., 1941.

An account is given of experiments carried out to evaluate the effect, if any, of various physical and biological factors on the growth of oöcysts of *Plasmodium cathemerium* in *Culex pipiens*, L. [*cf. R.A.E.*, B **29** 40]. The results showed that the size of oöcysts is not influenced by the degree of infection of the mosquitos or their activity, and probably not by the humidity of the environment. As it had previously been observed that oöcyst size varied in individual mosquitos of the same age, it is clear also that the age of the mosquito is not of importance. The factors governing the degree of infection are probably distinct from those governing the rate of growth of the oöcysts, but as yet the exact nature of these factors is not known.

HURLBUT (H. S.). **First Instar Characters for distinguishing the common Inland Species of Anophelines of eastern United States.**—*Amer. J. Hyg.* **34** (C) no. 1 pp. 47–48, 1 pl., 2 refs. Lancaster, Pa., 1941.

A key is given for distinguishing the larvae of *Anopheles quadrimaculatus*, Say, *A. crucians*, Wied., *A. punctipennis*, Say, and *A. walkeri*, Theo., in the first instar. The taxonomic characters are illustrated fully.

LE VAN (J. H.). **Methods for controlling *Aëdes aegypti* Mosquitoes with *Gambusia holbrooki* Minnows at Key West, Florida.**—*Publ. Hlth Rep.* **56** no. 23 pp. 1217–1221, 2 pls., 6 refs. Washington, D.C., 1941.

An account is given of the introduction of *Gambusia holbrooki* into cisterns and wells in Key West, Florida, for the control of *Aëdes aegypti*, L., the greater part of which is substantially the same as one already noticed [*R.A.E.*, B **29** 60]. A careful inspection of 2,376 containers in May and June 1940, rather more than a year after they had been stocked, revealed the presence of fish in 1,105 of them, and mosquito larvae were found in only 8 of these. Fish were found in roughly half of the cisterns inspected. Many of those from which they were absent had been pumped dry and had not been restocked when refilled. Mosquito larvae were found in 392 of the 869 cisterns, 216 of the 332 wells and 24 of the 70 barrels in which there were no fish. The disappearance of the fish from the wells and barrels can be largely explained by the ease with which they could be removed and the lack of interest shown by the owners.

HURLBUT (H. S.) & HEWITT (R.). **Sporozoites of *Plasmodium lophurae*, an Avian Malaria Parasite, in *Anopheles quadrimaculatus*.**—*Publ. Hlth Rep.* **56** no. 26 pp. 1336–1337, 3 refs. Washington, D.C., 1941.

Three instances of the experimental infection of Anophelines with species of *Plasmodium* that cause avian malaria have been recorded in the literature, but in each case, the infection did not develop beyond

the oöcyst stage. In this paper, an experiment is recorded in which sporozoites of *P. lophurae* [*cf. R.A.E.*, B **26** 188] were observed in one out of 29 females of *Anopheles quadrimaculatus*, Say, fed on infected ducks. Dissections were made 4–27 days after the infective feed, and the gland-positive mosquito was dissected on the 22nd day. It had developed an extremely heavy stomach infection. Sporozoites were few, but most of the oöcysts had not developed to maturity. Six of the other females contained oöcysts. As considerable importance is attached to oöcyst and sporozoite indices in *A. quadrimaculatus* in connection with endemic human malaria, some method of distinguishing between the exogenous stages of human and avian malaria in this species should be sought.

HAMMON (W. McD.), GRAY jr. (J. A.), EVANS (F. C.), IZUMI (E. M.) & LUNDY (H. W.). **Western Equine and St. Louis Encephalitis Antibodies in the Sera of Mammals and Birds from an Endemic Area.**—*Science* **94** no. 2439 pp. 305–307, 5 refs. New York, N.Y., 1941.

HAMMON (W. McD.), REEVES (W. C.), BROOKMAN (B.), IZUMI (E. M.) & GJULLIN (C. M.). **Isolation of the Viruses of Western Equine and St. Louis Encephalitis from** *Culex tarsalis* **Mosquitoes.**—*T.c.* no. 2440 pp. 328–330, 7 refs.

Evidence was obtained in 1940 indicating that the viruses of both western equine encephalomyelitis and St. Louis encephalitis were concerned in annual epidemics in man and horses in the Yakima Valley, Washington. Mouse-protection tests recorded in the first paper showed the presence in this area in 1941 of antibodies for both viruses in fowls, ducks, geese, pigeons, turkeys and other birds and also in cows, dogs, goats, horses, pigs, sheep and rodents. It appears that the antibodies in many of them are the result of specific infection, probably mild or inapparent. The findings indicate a much more widespread potential reservoir for both viruses than has generally been suspected, especially for St. Louis encephalitis. It would appear that barnyards and fowl-runs in small towns and rural and suburban areas are the principal foci of infection. The percentages of positives in domestic species were much greater than among wild ones.

In the second paper, it is pointed out that three types of epidemic virus encephalitis are recognised in North America. Two of these, the eastern and western types of equine encephalomyelitis, are generally believed to be mosquito-borne, in spite of failure to isolate the viruses from mosquitos collected in epidemic areas, and the third, St. Louis encephalitis, is associated with mosquitos by some observers [*cf. R.A.E.*, B **29** 127]. Mosquito-transmission of both types of equine encephalomyelitis has been repeatedly demonstrated in the laboratory [**25** 6, 128; **29** 38, etc.], and laboratory transmission of the virus of St. Louis encephalitis by *Culex pipiens*, L., was reported by T. Mitamura and his associates (*Trans. Jap. path. Soc.* **27** 573, 1937). The isolation of the viruses of both St. Louis encephalitis and western equine encephalomyelitis from *C. tarsalis*, Coq., taken in 1941 in routine collections in the Yakima Valley, where cases of human encephalitis occurred during that and the previous year, is here recorded. The methods are described. The 9,503 Arthropods collected included 7,619 mosquitos, of which 3,293 were *C. tarsalis*, the only species from which a virus was

isolated. The St. Louis encephalitis virus was isolated from one batch of 66 mosquitos and the western equine encephalomyelitis virus from a batch of 125. It is stated in a foot-note that two other viruses were isolated from lots of the same species but these have not yet been identified.

C. tarsalis is distributed throughout the United States west of the Mississippi. It is the commonest mosquito in the Yakima Valley, and the larvae are found in permanent ponds, irrigation seepage, barnyard drainage and sewage. Adults were taken in all areas where light-traps were used and occurred in large numbers in barns and houses. There are indications that they feed on man, horses, mules, cows and mallard ducks.

VARGAS (L.) & BELTRÁN (E.). *Culex quinquefasciatus*, **a new Vector of** *Plasmodium gallinaceum*.—*Science* **94** no. 2443 pp. 389–390, 2 refs. New York, N.Y., 1941.

Various species of *Aëdes* have been recorded as experimental vectors of *Plasmodium gallinaceum* [*R.A.E.*, B **27** 176, etc.], but species of *Culex* have proved to be refractory to the infection [**24** 297 ; **25** 121]. *C. fatigans*, Wied. (*quinquefasciatus*, auct.) is abundant in Mexico, and a female of a strain from Iguala was accidentally allowed to feed in the laboratory on fowls infected with the disease. On dissection, 29 days after it had first fed, abundant sporozoites were found in its salivary glands.

PAUL (J. R.) & others. **The Detection of Poliomyelitis Virus in Flies.**—*Science* **94** no. 2443 pp. 395–396, 5 refs. New York, N.Y., 1941.

Two cases are recorded of the detection of the virus of poliomyelitis (infantile paralysis) in flies during epidemics of the disease in 1941. In the first instance, a sample of roughly 1,000–2,000 flies, including a number of stated species among which blowflies predominated, were collected in Connecticut. Preparations of several hundreds of these flies were injected intraperitoneally and intranasally into a monkey, and it developed the disease 15 days later. Preparations of another sample of flies from Alabama, not specifically identified, but including blowflies, were similarly inoculated into a monkey, and it developed poliomyelitis after 9 days. During the same summer four other samples of flies from epidemic areas were tested in eight monkeys with negative results.

MAZZA (S.) & others. **Investigaciones sobre enfermedad de Chagas.**—*Publ. Misión Estud. Pat. reg. argent. Jujuy* no. 45, 152 pp., illus. Buenos Aires, 1940.

This publication comprises a series of 11 papers on various aspects of Chagas' disease in Argentina. Three of them deal with the prevalence of the causal agent, *Trypanosoma* (*Schizotrypanum*) *cruzi*, in Triatomids, and one of these and a fourth with infections in mammals

other than man, which comprised dogs, cats, foxes, a Mustelid, a squirrel, armadillos, bats and opossums.

In the Departments of Cafayate and San Carlos, Province of Salta, 424 and 626 examples, respectively, of *Triatoma infestans*, Klug, were taken in dwellings in the summer of 1936–37, and of these, totals of 241 and 333, including adults and nymphs in various instars, were infected with *T. cruzi*. Cases of the disease in man occurred in both areas. In October and November 1936, Triatomids were collected in the Departments of Molinos, Cachi and La Poma, Province of Salta. Of the 1,509 Triatomids taken in dwellings, among which *T. infestans* predominated in all localities, 545 were infected with metacyclic forms of *T. cruzi*, and were therefore capable of transmitting it to man. Two uninfected examples of *T.* (*Eutriatoma*) *oswaldoi*, Neiva & Pinto, were taken in one of the dwellings. Poultry houses close to dwellings harboured infected bugs, but not those at some distance, and 5 out of 17 adults and nymphs taken from the wall of a sheep enclosure were infected. Collections of Triatomids in dwellings were also made in a locality in the Province of Jujuy in which several cases of the disease were observed in 1937 ; they showed that 255 of 415 adults and nymphs in various instars were infected with *T. cruzi*. The spider, *Spiniger domesticus*, Pinto, which destroys the bugs, occurred in several of the dwellings.

SMITH (D. J. W.). **Studies in the Epidemiology of Q Fever. 8. The Transmission of Q Fever by the Tick** *Rhipicephalus sanguineus*.—*Aust. J. exp. Biol. med. Sci.* **19** pt. 2 pp. 133–136, 7 refs. Adelaide, 1941.

Experiments on the transmission of the causal agent [*Rickettsia burneti*] of Q fever [*cf. R.A.E.*, B **28** 227–9 ; **29** 171, etc.] were carried out with *Rhipicephalus sanguineus*, Latr., the common brown dog tick of Queensland [**28** 146], which also occurs in the Northern Territory and probably in northern New South Wales, and has been recorded on man, sheep, cattle, horse and cat, as well as dog. Engorged female ticks were collected in May 1940 and a laboratory stock established, guineapigs being used as hosts. The ticks of this stock showed no evidence of the presence of any agent pathogenic to guineapigs, and no rickettsiae were seen in smears of them. Larvae, nymphs and adults of both sexes were successfully infected with Q fever by feeding them on infected guineapigs during the febrile period, and the infection was passed from larvae to nymphs and from nymphs to adults but not from females to their progeny. Batches of nymphs and adults that had acquired the infection in the preceding stage transmitted it to about 63 and 92 per cent., respectively, of the guineapigs on which they fed. Rickettsiae were seen in smears of infected adults and nymphs. Of 24 adults examined by means of serial sections, a female that had engorged on a febrile guineapig and 4 out of 12 females and 7 out of 11 males that had been exposed to infection in either the larval or nymphal stage contained rickettsiae, which were abundant in the lumen and lining epithelium of the midgut, but apparently absent elsewhere. Invasion of the nuclei of infected cells was not observed. Faeces collected from adult ticks during their engorgement were highly infectious, 10^{-8} gm. being sufficient, 65 days after collection, to infect a guineapig. Suspensions of rickettsiae suitable for agglutination tests were readily prepared from infected ticks.

VAN THIEL (P. H.) & VAN OMMEREN (H.). **Verdere waarnemingen over de " patatta-luis " uit Suriname met aanteekeningen omtrent de reactie van de huid van den mensch op de aanwezigheid dier mijtlarven.** [Further Observations on the " Patatta " Mite in Dutch Guiana with Notes on the Reaction of the human Skin to the Presence of these Mite Larvae.]—*Geneesk. Tijdschr. Ned.-Ind.* **80** no. 27 pp. 1638–1654, 3 pls., 18 refs. Batavia, 1940.

After reviewing Schierbeek's investigations on larvae of *Trombicula* spp. in Dutch Guiana [*R.A.E.*, B **25** 277–278], the authors agree with her that the mite described from man by Linnaeus as *Acarus batatas* was almost certainly *T. flui*, van Thiel [*cf.* also **18** 215]. Though his description does not permit of identification, they consider that *T. flui* should be regarded as a synonym of *T.* (*A.*) *batatas*, L. From the rarity of *T. vanommereni*, Schierbeek, on man and its prevalence on lizards [**25** 278], they conclude that the larvae do not crawl to any height above the ground when waiting for a host. The larvae of *T. batatas* have been observed on fine grass, and are considered by the authors to have no direct connection with sweet potato (*Ipomoea batatas*). They were found in numbers in fields of cowpea (*Vigna sinensis*), but it was probable that they collected chiefly on grass and none was actually seen on cowpea. They were commoner in wet than in dry weather.

Some observations were made on the occurrence of the larvae on the human body. On adults they are mostly found on the legs and up to the waist ; on children they may occur much higher up the body, and up to 100 have been taken on a single child. As a rule, they do not appear to go higher than about a yard. The larvae soon attach themselves to the host and remain attached for 3–5 days, sometimes penetrating under the skin. They swell after a few days, become redder in colour and then turn nearly black. They feed on skin tissue and blood, and were easily removed by means of a vaccination needle, often by means of a match-stick. The reaction of the skin to infestation is described. The itching subsided in 1–2 days. The authors discuss the structure and function of the histosiphon by which the nites attach themselves to the host. It is a tube of variable length formed out of the tissues of the host, increases at the distal end and is surrounded by rings of necrotic tissue. It probably serves to gain access to the blood vessels.

MOOIJ (W.). **Malaria-prophylaxis in het Koninklijk Nederlandsch-Indische Leger.** [Malaria Prophylaxis in the Royal Netherlands Indies Army.]—*Geneesk. Tijdschr. Ned.-Ind.* **80** no. 38 pp. 2231–2241, 1 pl., 2 graphs, 1 ref. Batavia, 1940. (With a Summary in English.)

The author discusses the measures that are adopted in the Netherlands Indies to protect troops from malaria. In addition to the destruction of Anopheline breeding places and of mosquitos in buildings, the screening of living quarters and quinine prophylaxis, considerable protection is afforded by the use of special head veils and gauntlets that are worn out of doors at night, except during rain. These were introduced in 1937 in Java, and although a severe outbreak of malaria occurred among the civil population in 1938, the number of infections in the troops was less than in the preceding year. The author reviews

the literature on the size of mesh that is required in screens, etc., to afford protection from mosquitos and describes a method of estimating the fineness of cotton, expressed as the number of meshes (apertures) per inch. This means the sum of the holes counted along a line of the warp and a line of the bobbin in 1 sq. in. An apparatus for testing the effectiveness of screening materials, designed by him, consists of two compartments separated by a partition into which can be inserted the material to be tested. One of them is dark and the other light and provided with sugar solution. The mosquitos are liberated in the dark compartment in the morning and the apparatus is examined on the following morning. The mosquitos used were *Aëdes aegypti*, L. (*Stegomyia fasciata*, F.), *Culex fatigans*, Wied., and *Anopheles subpictus*, Grassi. They passed tulle with 23 apertures per inch but not that with 26. Copper gauze with apertures 1·25 mm. square and wire 0·3 mm. thick was passed on one occasion by a very small example of *Aëdes aegypti*. The manner in which mosquitos fly through screens, by closing their wings at the moment of passage, is described.

TOUMANOFF (C.). **Les " black spores " de Ross et la " dégénérescence brune " des microfilaires chez les moustiques, conception nouvelle sur leur nature et origine possibles. Considérations sur la " chitinisation " défensive chez les insectes.**—*Rev. méd. franç. Extr.-Orient* **18** no. 4–5 pp. 173–197, 10 figs., 26 refs. Hanoi, 1940.

In the course of the dissection of more than 30,000 Anophelines in Indo-China between 1931 and 1939, true " black spores of Ross " [*R.A.E.*, B **21** 77] were found in only four individuals, all of which were infected with malaria parasites. The black spores, which are considered by certain authors to be chitinised malaria parasites [*cf.* **26** 222, etc.], are thought rather to be degenerated sporocysts filled with a black pigment produced in the course of degeneration [**21** 77].

" Brown degeneration " of microfilariae observed by various workers in the thoracic muscles or malpighian tubes of mosquitos has been attributed by them to chitinous encapsulation [*cf.* **28** 42, 249]. In his work on the vectors of *Filaria* (*Dirofilaria*) *immitis* in dogs [**28** 126], the author observed such degenerate microfilariae in the malpighian tubes of some of the mosquitos; he describes experiments which proved that in their case, decomposition results not in chitinisation but in the formation of a black pigment, which has the characters of melanine. This observation supports the hypothesis brought forward on the nature of black spores. The part played by the tracheae [*cf.* **17** 254] in the formation of black spores is shown to be the provision of oxygen.

MENU (P.) & TOUMANOFF (C.). **Le choix d'emplacement des campements et les indisponibilités pour le paludisme dans les effectifs militaires en campagne.**—*Rev. méd. franç. Extr.-Orient* **18** no. 8 pp. 519–528, 1 graph, 4 plans, 7 refs. Hanoi, 1940.

Brief descriptions and plans are given of four camp sites chosen for troops stationed for four months for the purpose of road building in a part of Indo-China where malaria is endemic and the chief vector is *Anopheles minimus*, Theo. Where possible, the camps were placed at a distance from native villages and from water, and where any water there

might be, even though not very close, was shaded and separated from the site by dense forest. Clearing of water-courses was forbidden as, thus exposed to the sun, they become particularly favourable breeding places for the vector species, and care was taken to expose only the minimum area for obtaining a supply of water, preserve sufficient shade and keep the banks in good condition. Lists are given of the species of *Anopheles* found, if any, in surveys of the streams near the sites. Two of the camps were extremely well placed ; the others for technical reasons were less favourably situated. The malaria rate in all camps was low, but, although a uniform prophylactic weekly distribution of quinacrine was made, the proportion of ineffectives was markedly higher in the least well placed camp, where the nearest breeding places, though at some distance, were free of vegetation and exposed to the sun.

GENEVRAY (J.) & HOANG-TICH-TRY. **Etude malariologique de la région Tong Sontây.**—*Rev. méd. franç. Extr.-Orient* **18** no. 9–10 pp. 566–573, 1 fldg. map. Hanoi, 1940.

In March 1932, malaria was reported among Air Force personnel at the Tong camp in Tonkin. Investigation of the camp and immediate surroundings revealed the presence of nine species of Anophelines, including *Anopheles aconitus*, Dön., *A. jeyporiensis*, James, and *A. minimus*, Theo. Experiments were begun in January 1933 on control of the larvae by dusting with Paris green from aircraft. Applications every ten days were followed by a considerable decrease in the number of cases of malaria and days of work lost. The situation was much better in the following years. In 1939, the region of Tong and Sontay was chosen for the establishment of a large industrial centre. As the introduction of large numbers of men into a malarious zone with numerous Anopheline vectors was bound to create a grave situation unless adequate prophylactic measures were promptly taken, epidemiological and Anopheline surveys were made and the results are given in some detail. Three additional species of *Anopheles* were taken, but it is concluded that though the Anopheline fauna is rich, the species of importance are the three mentioned above. *A. minimus* and *A. jeyporiensis* are well-known major vectors, and *A. aconitus*, though a secondary vector, is the most widely distributed in this area. So far as could be ascertained, the number of breeding places that would have to be treated was not large.

GALLIARD (H.) & DANG-VAN-NGU. **Une espèce nouvelle d'*Anopheles* du Tonkin, *A. tonkinensis* sp. nov.**—*Rev. méd. franç. Extr.-Orient* **18** no. 9–10 pp. 595–598, 3 pls., 3 refs. Hanoi, 1940.

Descriptions are given of the larva, pupa, adult female and male genitalia of *Anopheles tonkinensis*,* sp. n., larvae of which were found in a rock pool on the coast of the Gulf of Tonkin in May 1938.

* The name *tonkinensis* has already been used by Toumanoff for a variety of *A. jeyporiensis*, James, that is considered by Christophers to be identical with *A. j. candidiensis*, Koidz. [*cf. R.A.E.*, B **20** 62; **21** 280].—Ed.

DE MEILLON (B.) & DE CARVALHO PEREIRA (M.). **Notes on some Anophelines (Dipt. Culicidae) from Portuguese East Africa.**— *Moçambique Docum. trim.* no. 23 pp. 69–83, 9 pls., 4 refs. Lourenço Marques, 1940.

The material dealt with in this paper was collected during an Anopheline survey of Portuguese East Africa made early in 1940. It included the four members of the *funestus* series recognised by Leeson [*R.A.E.*, B **26** 75], *viz. Anopheles funestus*, Giles, *A. leesoni*, Evans, *A. rivulorum*, Leeson, and *A. rivulorum* var. *garnhamellus*, Evans & Leeson, but examination of the specimens obtained showed that it is impossible to identify the adults of this series by the characters used by him, and the position is very confused. The identification of the larvae of the three species remains comparatively simple. Their distribution in the colony is shown on a map. *A. funestus* was absent from only two places in which a thorough search was made. A possible explanation of its absence is that the country in both cases was hilly and the small streams flowed very rapidly. The larvae were sometimes not found where the adults were present. All the larvae collected and the many adults reared were typical, and all but three of the 334 adult females collected from 29 different localities fell into Leeson's four groups of wing patterns [*loc. cit.*]. The larvae were usually found along the sides of small streams or rivers, in quiet shaded water, with vegetation consisting of grass or reeds, but they were twice found among floating Nile lilies (*Eichhornia* sp.) and twice among *Pistia*. On many occasions, however, they were not found among *Pistia*. They were also taken in lakes, dams or ponds in which the water was clear and shaded, and, on four occasions, in rice-fields. The largest number of larvae in any one breeding place was found in a small pool of fairly clean water with scanty shade along the sides and with almost the whole surface covered by leaves of a species of *Marsilia*, which rested flat upon it and provided no shade. The stream adjoining the pool appeared to be an ideal breeding place for *A. funestus*, but no larvae of this species were found in it.

An examination of large numbers of larvae resembling those of *A. rivulorum* showed that the characters supposed to separate the typical form and var. *garnhamellus* are variable and intergrade. The wing characters of the reared adults were also variable and could not be correlated with the larval characters, so that the two forms could not be distinguished from one another or, by wing characters, from *A. funestus*. It might be concluded either that the specimens from Portuguese East Africa represent a new form in which the larva resembles *A. rivulorum* and its variety and the adult *A. funestus*, or that *A. rivulorum* is a variable species, which is easily separable from *A. funestus* except in Portuguese East Africa, and that *garnhamellus* is merely an individual variation of it. The latter view is provisionally adopted by the authors. It follows from the facts given that some of the adults taken in habitations and identified as *A. funestus* may have been *A. rivulorum*. This cannot be determined without examining their pharyngeal armature. The breeding places of this species are similar to those of *A. funestus*, though the two species were not invariably found together. No adults and only three larvae of *A. leesoni* were found; the one female reared was typical of the species. The larvae were taken in rivers among grass or *Pistia*.

The larva and adult of *A. brunnipes*, Theo., are described. Examination of the larvae, which were found for the first time, showed that it belongs to the *Myzomyia* and not to the *Neocellia* group. Large numbers were taken in a series of small shallow pools of fresh water in an open drain along a road. One adult was taken indoors. The discovery of larvae of the form described as *A. theileri* var. *seydeli*, Edw. [**18** 43] shows that it does not belong to the *theileri* series but to the *marshalli* series. It is therefore considered a distinct species. Descriptive notes are given on the larva and adults. The larvae were taken in the shade of short grass along the side of a very fast running stream with perfectly clear water, and from slowly moving water in almost complete shade under a culvert. Descriptions are given of the adults, pupa and larva of *A. marshalli* var. *mousinhoi*, n., which was reared from larvae collected amongst grass and aquatic vegetation in a permanent swamp with water two feet deep or less. The males are indistinguishable from the typical *A. marshalli*, Theo.

RAKHMANOVA (P. I.). [**The Types of gonotrophic Cycle in Anophelines in natural environmental Conditions.**]—*Vopr. Phisiol. Ekol. malar. Komara* **1** pp. 96–112, 6 graphs. Moscow, 1940. (Abstract in *Riv. Malariol.* **19** (2) pt. 1–4 bis pp. 104–105. Rome, 1940.)

In populations of *Anopheles maculipennis* var. *messeae*, Flni., in the Province of Moscow and *A. maculipennis* var. *sacharovi*, Favr, and *A. pulcherrimus*, Theo., in Suir-Dar'ya and Turkmenistan, more of the females are in stage 2 of the gonotrophic cycle [*R.A.E.*, B **29** 93] than in any other stage, but in *sacharovi* and *pulcherrimus*, which are southern forms, there is a greater prevalence of individuals in the final stage of the cycle and a tendency to accelerate the relative rate of development of the ovaries. It is concluded from the observations on *messeae* that the stage in which the greatest number of mosquitos occurs may vary with the locality in accordance with the rate of ovarian development. The influence of season is shown by the appearance of a true diapause in autumn and of gonotrophic dissociation, which is related to the temperature of the environment. Although in experiments, temperatures much above or below the optimum retard ovarian development, the curves for *messeae* in 1935 and 1936 were very similar, in spite of differences in temperature. This can be explained, however, by the fact that the average temperatures in both years were close to the optimum and that mosquitos seek favourable microclimates for their day-time shelters, so that a real difference could appear only if there were no shelters with microclimates near the optimum.

DENISOVA (S. M.). [**Variability of the Hypopygia of** *Anopheles maculipennis messeae*, **Flni., in the Anopheline Population of Marbumstroi (Mariïskaya, U.S.S.R.).**]—*Vopr. Phisiol. Ekol. malar. Komara* **1** pp. 113–119, 9 figs. Moscow, 1940. (Abstract in *Riv. Malariol.* **19** (2) pt. 1–4 bis p. 107. Rome, 1940.)

The author describes and illustrates variations in the morphology of the basal lobes of the hypopygia of males of *Anopheles maculipennis* var. *messeae*, Flni., collected at Marbumstroi (on the upper Volga), and states that the range is so great that the hypopygium of var.

messeae often resembles that of var. *atroparvus*, van Thiel, and var. *typicus*, thus rendering uncertain the classification of a population of *Anopheles maculipennis*, Mg., if only a few males are examined.

Polezhaev (V. G.). [**The daily Rhythm in Behaviour of Females of *Anopheles maculipennis* var. *messeae*, Flni., and its Causes.**]—*Vopr. Phisiol. Ekol. malar. Komara* **1** pp. 120–133. Moscow, 1940. (Abstract in *Riv. Malariol.* **19** (2) pt. 1–4 bis p. 104. Rome, 1940.)

Females of *Anopheles maculipennis* var. *messeae*, Flni., show a clearly defined daily rhythm in activity, which begins shortly before sunset and ceases in the morning. By day, they remain inactive in a dark place. This cycle was reversed after two days by exposing them to strong light at night and darkness by day. No spontaneous movement occurs, however, in females that are not hungry, thirsty or sexually active. Light decreases activity, but excessive hunger or thirst causes flight in spite of bright illumination. Fatigue after several hours of activity is thought to explain why mosquitos, kept hungry during the night, become inactive in the morning and do not fly even in reduced light.

Raevskiĭ (—). [**The Microclimate of the Winter Quarters and the Behaviour of the hibernating Females of *Anopheles maculipennis* var. *messeae*, Flni.**]—*Vopr. Phisiol. Ekol. malar. Komara* **1** pp. 135–151, 3 figs. Moscow, 1940. (Abstract in *Riv. Malariol.* **19** (2) pt. 1–4 bis pp. 103–104. Rome, 1940.)

From December 1934 to February 1935, the author studied the variations in the microclimate of an experimental winter shelter for *Anopheles maculipennis* var. *messeae*, Flni., and the behaviour of the females hibernating in it. The temperature in the shelter varied by 4–5°C. [7·2–9°F.] at various points ; it was higher at the walls than the average for the shelter as a whole during the first half of the period and lower during the second. The overwintering females showed the same marked negative geotaxis as summer individuals. Relative humidity, which was above 60 per cent., did not influence the distribution of the mosquitos in the shelter. In the presence of fairly uniform temperature and humidity, light was the main factor, the mosquitos preferring the darkest places. In a relatively warm environment, they were in continuous slow movement. The behaviour of the overwintering mosquitos is classified as typical of summer, semi-hibernation and hibernation; the degree of complexity of the reaction to stimuli varied directly with environmental temperature. In relatively warm surroundings, the fat-body was rapidly exhausted, giving rise to weakness and consequent variation in the reaction to stimuli. Hibernation did not interrupt the tendency of some individuals to leave the shelter. As in summer, flight occurred at sunset and was probably due to hunger caused by premature exhaustion of the fat-body. The number of weakened individuals increased towards spring, and they came down from the ceiling and upper part of the walls and died.

Avdeeva (T. Ya). [**The Occurrence of** *Plasmodium* **in** *Anopheles* **and its Variations in Relation to the Age of the Mosquito.**]—*Vopr. Phisiol. Ekol. malar. Komara* **1** pp. 153–171, 6 graphs. Moscow, 1940. (Abstract in *Riv. Malariol.* **19** (2) pt. 1–4 bis pp. 102–103. Rome, 1940.)

The investigations described were carried out on a collective farm in the Caucasus in which malaria was endemic and the Anopheline population dense but fairly well deviated by cattle. *Anopheles maculipennis*, Mg., was represented by vars. *typicus* and *sacharovi*, Favr; the former predominated during the first half of summer and the latter during the second. The age of the females was estimated [according to the method of Mer (*R.A.E.*, B **21** 71)] by the development of the ampullae of the oviducts. Females of the first gonotrophic cycle predominated in both varieties. The oöcysts of *Plasmodium* first appeared about the end of the first and the beginning of the second gonotrophic cycle, and sporozoites were found in the salivary glands of females of *sacharovi* with ampullae of 0·04628–0·05172 sq. mm. and of *typicus* with ampullae of 0·05172–0·05717 sq. mm. The percentage of females infected distinctly increased with age in *sacharovi*, but the increase was less marked in the case of *typicus*, possibly owing to the small number of individuals examined. The total percentage was greater in *sacharovi* than in *typicus*, owing to the fact that *sacharovi* predominates in autumn, when infection is at its maximum, while *typicus* is abundant in June, when infection is nil. If the percentages for a given month were compared, the differences were insignificant. In the Caucasus, where *typicus* is a more dangerous vector than in the Balkans, there are severe foci of malaria due to it alone.

Spanedda (A.). **Tipi di anofelini esistenti in provincia di Cagliari.** [Anophelines in the Province of Cagliari.]—*Rass. med. sarda* **42** no. 4 pp. 119–123. 1940. (Abstract in *Riv. Malariol.* **19** (2) pt. 1–4 bis pp. 109–110. Rome, 1940.)

From 928 Anophelines taken in dwellings and animal quarters in the Province of Cagliari, Sardinia, 546 egg-batches were obtained. Examination of their characters showed that 95·4 per cent. of the population is represented by *Anopheles maculipennis* var. *labranchiae*, Flni. It is stated that var. *sacharovi*, Favr (*elutus*, Edw.) was found in only one locality, where malaria was specially severe, and vars. *atroparvus*, van Thiel, and *melanoon*, Hackett, which are zoophilous, only where malaria was abating, but the Italian abstractor points out that these statements are not supported by the tables given.

Papers noticed by Title only.

Toumanoff (C.). **Contribution à la connaissance des ixodidés de l'Indochine du gen.** *Haemaphysalis* **Koch, C. L.** [descriptions of seven species from wild mammals, including three new ones].—*Rev. méd. franç. Extr.-Orient* **18** no. 8 pp. 463–490, 17 figs., 6 refs. Hanoi, 1940.

BONNE-WEPSTER (J.). **Notes on Mosquitoes from the Netherlands Indies : A new** *Finlaya* [*Aëdes* (*F.*) *gani*, sp. n.] **from New-Guinea.** —*Meded. Dienst Volksgezondh. Ned.-Ind.* **29** no. 3–4 pp. 158–159, 6 figs. Batavia, 1940.

MAZZA (S.) & JÖRG (M. E.). **Estudios sobre Triatomidae argentinos. Variabilidad del diseño somático de** *Triatoma infestans* **Klug.** [Studies on Argentine Triatomids. Variability in the Markings of *T. infestans*.]—*Publ. Misión Estud. Pat. reg. argent. Jujuy*, no. 49, 22 pp., 13 figs., 3 refs. Buenos Aires, 1940.

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* For relation to disease, see under Anaplasmosis, Dengue, Encephalitis, Encephalomyelitis (Equine), Ephemeral Fever, *Filaria* spp., Malaria, Poliomyelitis, *Spirochaeta anserina*, Tularaemia, Yellow Fever.

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